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Dixon Sand (Penrith) Pty Ltd

HAERSES ROAD QUARRY EXTRACTION AREA MODIFICATION

Environmental Assessment

FINAL

September 2016

Dixon Sand (Penrith) Pty Ltd

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Environmental Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Dixon Sand

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Executive Summary

Background

Dixon Sand (Penrith) Pty Limited (Dixon Sand) operates the Haerses Road Quarry located on Haerses Road at Maroota, NSW. Haerses Road Quarry was granted development consent (DA 165-7-2005) by the Minister for Planning in 2006. The development consent provides for the extraction of 250,000 tonnes per annum (tpa) for a period of 25 years. The Quarry extracts sand from the Tertiary Maroota Sand deposit.

Due to the recent increases in demand for medium to coarse grain sands and specialist sands in the Sydney market, Dixon Sand is seeking to modify the development consent for the Haerses Road Quarry to increase the extraction area to target a friable sandstone resource and to extend the life of the quarry. The friable sandstone resource will expand the suite of sand products provided by Hearses Road Quarry, assisting to meet this market demand.

Approval for the proposed changes (the Modification) is being sought by Dixon Sand under Section 75W of the *Environmental Planning and Assessment Act 1979*.

The Modification

The Modification involves increasing the extraction area to quarry a friable sandstone resource in addition to the tertiary sand deposit as well as including provision of additional plant and equipment at the site to provide for the processing of the friable sandstone and tertiary material. The key components of the Modification include:

- new 30 year quarry life from 2016 to 2046 based on the extent of the available resource
- increasing the extraction area by approximately 19 hectares to allow extension into the friable sandstone resource within Lots 177 DP 752039 and 216 DP 752039 (refer to **Figure 1.3**). The friable sandstone would be extracted using similar methods and equipment as currently used at the site, being a dozer, excavator, trucks and a loader
- addition of mobile crushers (one jaw crusher and one rotary crusher) to break sandstone clumps prior to screening using the existing dry screening plant
- addition of a mobile wet plant to wash the crushed friable sandstone and tertiary material to remove clay fines from the sand product. This will allow processing at the Hearses Road site as opposed to necessarily having to transport it to the Dixon Sand's Old Northern Road Quarry for processing

- importation of up to 100,000 tpa of clean recycled Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM). The VENM and ENM would be reprocessed by blending with product from either the Haerses Road Quarry or Old Northern Road Quarry prior to sale . VENM or ENM would also be used to achieve the final landform where there is a shortfall in overburden or fines from the washing process

- utilise the existing approved traffic movements between Old Northern Road and Hearses Road quarries to allow for blending of speciality sands, including VENM and ENM. No new traffic movements would be generated by the proposed modification and there would be negligible change to traffic generation between quarries as a result of the Modification

- use of mobile washing and processing plant on site, utilising water from existing water licence provisions

- installation of additional detention basins and associated water management infrastructure

- establishment of site office, workshop and weighbridge

- progressive rehabilitation of the proposed additional extraction area.

Need and Benefit of the Modification

The modified quarry would provide a long-term, high quality supply of construction materials into the Sydney local and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and will contribute to the security and economic viability of the Sydney construction industry along with supply to other key sand markets.

The Modification would result in a decrease in the number of truck movements through the township of Maroota and past Maroota Public School. The Modification would also increase employment at the site with up to eight full time jobs required.

There is no proposal to increase currently approved production rates and associated traffic movements to and from site, reducing the potential for changes in impacts from those currently approved.

Broad Overview of Environment Impacts

This Environmental Assessment (EA) includes a detailed assessment of the potential environmental and social impacts of the Modification and identifies the management and mitigation measures that will be implemented as part of the Modification. A brief summary of the key findings of the assessment process is provided in **Table 1**.

Table 1 Summary of the Key Environmental Impact Assessment Findings

Environmental issues	Overview of Potential Impacts
Groundwater	Groundwater monitoring data was used to establish groundwater elevations for the Maroota Tertiary Sands Groundwater Source (MTSGS) and the Sydney Central Basin Groundwater Source (SCBGS). The highest recorded water level measured in each bore was used to develop a maximum potential extraction depth. The maximum extraction depth represents an elevation of two metres above the wet weather groundwater level sources. The Modification has been designed to avoid impacts on groundwater by not impacting on the MTSGS and by staying a minimum of two metres above the wet weather groundwater level of the SCBGS. The Groundwater Assessment found that: • the proposed extraction area remains entirely in the unsaturated zone and will not result in capture of groundwater • the MTSGS and SCBGS will not be intercepted during quarrying operations • there will be no interference with neighbouring bores • no groundwater supply works are being carried out as part of the Modification.
Surface Water	To manage potential water quality impacts on downstream watercourses and users throughout the life of the quarry, it is proposed to maintain the approved water management system for the quarry and install additional sediment basins and associated drains to manage dirty water from the proposed new extraction area. The Modification is predicted to have negligible potential impacts on water quality on downstream watercourses due to the proposed proper design, installation and maintenance of water management infrastructure in accordance with Landcom's *Managing Urban Stormwater Soils and Construction Volume 1 and Volume 2e – Mines and Quarries* (the Blue Book) (2004). Water balance modelling indicates that the Modification will not result in any water discharges from site during an average rainfall year. This is consistent with existing quarry operations where no water discharges have occurred from the operations. The water management system catchment area for Haerses Road Quarry would increase to 0.9 per cent of the total catchment area of Little Cattai Creek (as compared to 0.7 per cent for the existing operations), as such it is considered that the Modification will have negligible impact on annual flow volumes or flooding in Little Cattai Creek.

Environmental issues	Overview of Potential Impacts
Noise	Noise modelling was carried out for representative worst case scenarios. Noise levels during early near surface level extraction in Cells 1 and 3 were predicted to marginally exceed the consent noise limits by 1 dB(A) at two receiver locations to the west of the proposed extraction area. Similar noise levels are expected in Cell 2. This minor degree of exceedance would barely be perceptible. Similar noise levels are expected during clearing and pre-stripping operations. In Cell 4 and Cell 5, noise levels during at surface and early near surface level extraction (and later stages of pre-stripping when carried out behind the bund wall) are predicted to marginally exceed the noise limits by up to 2 dB(A) at the nearest receivers. Reasonable and feasible mitigation measures have been incorporated into the design of the Modification. Noise levels will progressively reduce as the extraction pit depth is increased. Road traffic noise levels are predicted to comply with the nominated Road Noise Policy noise criteria during both day and night periods.
Air quality	Dust emissions during operation of the modified quarry have been estimated based on activities and equipment that would be operating at the site. The results for the incremental increases from the Modification on an annual and worst case operational basis, when added to the background concentrations are below the respective EPA criteria for all of the potential pollutants (PM10, PM2.5, total suspended particulates and dust deposition). The results for the cumulative assessment indicate that there is potential for a maximum of four additional exceedances of the cumulative 24-hour PM_{10} impact assessment criteria of 50 µg/m^3 per year for the most affected receiver. If the worst day operations happened to coincide with already elevated background concentrations, the relevant criteria may be exceeded. However this outcome is considered unlikely to occur. For the cumulative 24-Hour PM2.5 the result indicate that the Modification would be unlikely to result in any days over the impact assessment criteria of 25 µg/m^3, and that the Modification would have a very minimal impact on current $PM_{2.5}$ concentrations.

Environmental issues	Overview of Potential Impacts
Ecology	A detailed Biodiversity Assessment Report (BAR) was prepared to assess the potential ecological impacts of the Modification using the Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (FBA). The proposed extraction area supports 0.08 hectares of Coastal Upland Swamp(s) which is listed under the *Threatened Species conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Modification has been designed to avoid a larger area of this community that occurs to the north of the Modification disturbance area. Threatened species that were identified within the modification disturbance area are: • *Darwinia biflora* • *Grevillea parviflora* subsp. *supplicans* • *Tetratheca glandulosa* • Dural woodland snail (*Pommerhelix duralensis*) • Eastern pygmy-possum (*Cercartetus nanus*) • large-eared pied bat (*Chalinolobus dwyeri*) • little bentwing-bat (*Miniopterus australis*). The BioBanking Credit Calculator (Major Project Assessment Type) was used to determine the credits required for the Modification. In summary, the Modification requires 962 ecosystem credits and 2581 Species credits. Dixon Sand is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Modification. Firstly, Dixon Sand has sought to design the Modification to avoid and minimise ecological impacts in the project planning stage and a range of impact mitigation strategies have been included in the Modification to mitigate the impact on biodiversity values. Fulfilling offset requirements under the FBA will be undertaken using one or a combination of the following offset strategies: • on-site in-perpetuity conservation of applicable credits • offsetting through a site secured by a BioBanking Agreement • potentially securing required credits through the open credit market, off site, if required • if suitable offsets are unavailable, contributing money to supplementary measures in accordance with relevant conservation or recovery actions will be investigated. It is currently proposed that the biodiversity offset strategy will consist of the following: • establishment of proponent-managed offset sites at Haerses Road and Porters Road • purchase of credits from the Biodiversity Credits Register for the residual credits that need to be retired.

Environmental issues	Overview of Potential Impacts
Traffic and transport	The Modification would not change the total traffic movements for the quarry. The ability to transport a greater proportion of product, potentially all product, direct to market would result in a decrease in truck numbers on Old Northern Road passing Maroota Public School and the township of Maroota. The key intersections potentially affected by the Modification are the T intersection of Haerses Road with Wisemans Ferry Road and Wisemans Ferry Road with Old Northern Road. Observations on site show that both of these intersections operate very well with no delays for the majority of traffic movements. Traffic turning into or out of the side road typically did not need to stop and the only delay was that associated with manoeuvring through the intersection. A Sidra intersection analysis has been completed at the intersection of Old Northern Road and Wisemans Ferry Road and the analysis confirms that the intersection operates very well with negligible delays and congestion. All movements have Level of Service A and the delays are less than 7 seconds for all movements. It is considered that the intersection of Haerses Road and Wisemans Ferry Road would operate to a similar level of service and delays. With no increase to the truck numbers at this location the intersection will continue to operate at this level of service.
Visual amenity	Based on topography only (i.e. no allowance for screening vegetation) an assessment of the visual catchment indicates that the additional extraction area would be visible for a small number of residences to the west of the site located on the southern side of Wisemans Ferry Road. Taking into account screening vegetation it is likely that only those residences with an existing view of the approved Stage 5 quarry operations at Haerses Road Quarry would also have views, or partial views, of the additional extraction area. As the additional extraction area is down slope of the currently operational Stage 5 this would generally appear as a continuation of the existing operational area with very similar visual characteristics. Similarly, based on topography only (i.e. no allowance for screening vegetation) there is the potential that some residences to the east of the site may have views to the proposed processing area. This would represent a fairly minor change to the existing situation where the mobile screening plant may be located within any part of the active stages of the approved operations and would also be potentially visible. The weighbridge and car parking area (12 spaces) would be adjacent to Haerses Road and be of minor visual impact and will not be visually inconsistent with the existing built elements in this area.
Aboriginal heritage	An Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) has been undertaken for the Modification in compliance with the Office of Environment and Heritage (OEH) *Aboriginal Cultural Heritage Consultation Requirements (ACHCRs) for Proponents* (2010). No Aboriginal artefacts were identified during the survey of the Modification disturbance area that was undertaken with four Aboriginal party representatives. No areas of Potential Archaeological Deposit (PAD) were identified during the survey. The proposed extraction area is considered to have low archaeological potential based on a number of factors including: the landforms are not suitable for camping, soils are skeletal and unlikely to retain archaeological deposit; and water sources in the immediate vicinity of the proposed extraction area are ephemeral at best and would not support prolonged occupation.

Further details of the predicted environmental and social impacts of the Modification are provided in the main text of this EA and associated technical reports. The EA includes commitments by Dixon Sand to the implementation of management, mitigation and offset measures to minimise the predicted impacts of the Modification.

Conclusion

The Modification has been assessed against the principles of ecologically sustainable development (ESD) as required by the NSW *Environmental Planning and Assessment Act 1979*. This assessment has indicated that the Modification is consistent with the principles of ESD.

On considering the balance of the potential impacts of the Modification on the environment and community, and the benefits of and the need for the proposed changes, it would be reasonable to consider that with the implementation of the management, mitigation and offset measures proposed by Dixon Sand the benefits of the Modification outweigh the impacts.

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

Dixon Sand (Penrith) Pty Limited (Dixon Sand) operates the Haerses Road Quarry located on Haerses Road at Maroota, NSW (refer to **Figure 1.1**). Haerses Road Quarry was granted development consent (DA 165-7-2005) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) by the Minister for Planning on 14 February 2006. The development consent provides for the extraction of 250,000 tonnes per annum (tpa) for a period of 25 years. The Quarry extracts sand from the Tertiary Maroota Sand deposit.

Due to the recent increase in demand for medium to coarse grain sands and specialist sands in the Sydney market, Dixon Sand is seeking to modify the development consent for the Haerses Road Quarry to increase the extraction area to target a friable sandstone resource. The friable sandstone resource will expand the suite of sand products provided by Hearses Road Quarry, assisting to meet this market demand. Dixon Sand also propose some other changes to the approved quarry operations as discussed in **Section 1.1**.

Dixon Sand has consulted with the Department of Planning and Environment (DP&E) in regard to the proposed modification and is seeking approval to modify the development consent under Section 75W of the EP&A Act, to provide for the proposed changes. This Environmental Assessment (EA) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Dixon Sand to assess the potential environmental and social impacts associated with the proposed modification. The EA will be a supporting document to the modification application lodged with DP&E.

1.1 Overview of the Proposed Modification

Dixon Sand has been operating the Haerses Road Quarry (the site) since consent was granted in 2006 (refer to **Figure 1.2**). The resource contains a Tertiary deposit of fluvial and eluvial sediments that are suited for use as concrete and specialty sands (ERM, 2005).

The development consent currently allows for extraction of 7 million tonnes from the site over 25 years at a rate of 250,000 tonnes per annum (tpa). The consent allows for hauling of 190,000 tpa of screened sand to the processing facility at Dixon Sand's Old Northern Road Quarry located approximately two kilometres to the north, and hauling of 60,000 tpa of screened sand direct to local and regional markets.

The proposed modification involves increasing the extraction area to quarry a friable sandstone resource in addition to the tertiary sand deposit as well as including provision of additional plant and equipment at the site to provide for the processing of the friable sandstone and tertiary material. The key components of the proposed modification (the Modification) include:

- new 30 year quarry life from 2016 to 2046 based on the extent of the available resource
- increasing the extraction area by approximately 19 hectares to allow extension into the friable sandstone resource within Lots 177 DP 752039 and 216 DP 752039 (refer to **Figure 1.3**). The friable sandstone would be extracted using similar methods and equipment as currently used at the site, being a dozer, excavator, trucks and a loader
- addition of mobile crushers (one jaw crusher and one rotary crusher) to break sandstone clumps prior to screening using the existing dry screening plant
- addition of a mobile wet plant to wash the crushed friable sandstone and tertiary material to remove clay fines from the sand product. This will allow processing at the Hearses Road site as opposed to necessarily having to transport it to the Dixon Sand's Old Northern Road Quarry for processing

- importation of up to 100,000 tpa of clean recycled Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM). The VENM and ENM would be reprocessed by blending with product from either the Haerses Road Quarry or Old Northern Road Quarry prior to sale. VENM or ENM would also be used to achieve the final landform where there is a shortfall in overburden or fines from the washing process

- utilise the existing approved traffic movements between Old Northern Road and Hearses Road quarries to allow for blending of speciality sands, including VENM and ENM. No new traffic movements would be generated by the proposed modification and there would be negligible change to traffic generation between quarries as a result of the modification

- use of mobile washing and processing plant on site, utilising water from existing water licence provisions

- installation of additional detention basins and associated water management infrastructure

- establishment of site office, workshop and weighbridge

- progressive rehabilitation of the proposed additional extraction area.

Haerses Road Quarry operates 7am to 6pm, Monday to Saturday, with vehicle access to and from the site and loading activities permitted from 6am. There is no change proposed to the operating hours as part of the Modification.

The modification would not change the annual production volume of the quarry and would require no increase in total truck movements. A community benefit of the Modification is that it would result in a reduction in the number of truck movements past the township of Maroota and Maroota Public School. Dixon Sand has a good environmental and community record over the 10 years of operation of its two Maroota quarries. An existing Community Consultative Committee is in operation for its two quarries and Dixon Sand is committed to working with the community representatives to achieve the best possible workable outcomes.

1.2 Site Context

1.2.1 Environmental Setting and Land Use

Quarry operations at the site commenced in 2006 with Stage 1 of the five approved stages (refer to **Figure 1.4**). The Stage 1 area contains fine sands which are suitable for blending with other coursers grains extracted from the site. As such, Stage 1 will remain open throughout the life of the quarry or until the resource in this area is completed. Currently, Stages 1 and 2 are open with Stage 1 approximately 60% complete and Stage 2 approximately 30% complete.

Prior to the commencement of quarrying activities, the site was used for orchards and growing horticultural crops with parts of the site consisting of native vegetation. There were previously five dwellings located along Haerses Road. There are now three dwellings along the northern part of Haerses Road as well as one former dwelling house which is now used as the Dixon Sand Haerses Road Quarry site office. These land uses currently continue within the site in addition to the quarrying operations.

The friable sandstone resource proposed to be extracted covers the portion of the site to the west and south of the approved extraction area, as shown in **Figure 1.3**. This area currently consist of dense native vegetation, some cleared land and a dam currently used as part of the site's water management system.

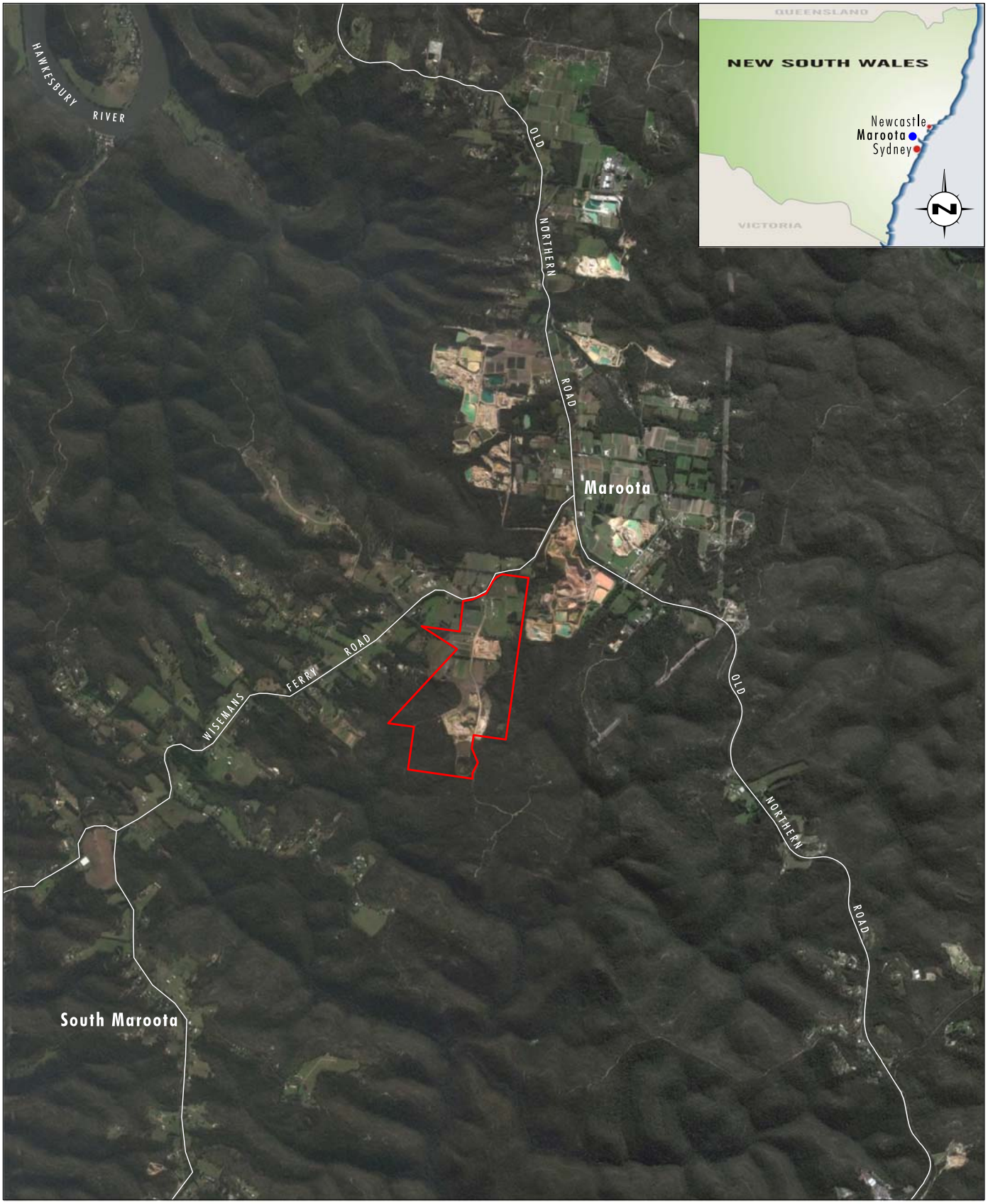

Image Source: Google Earth (2014)

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Legend

Haerses Road Quarry Site

FIGURE 1.1

Locality Map

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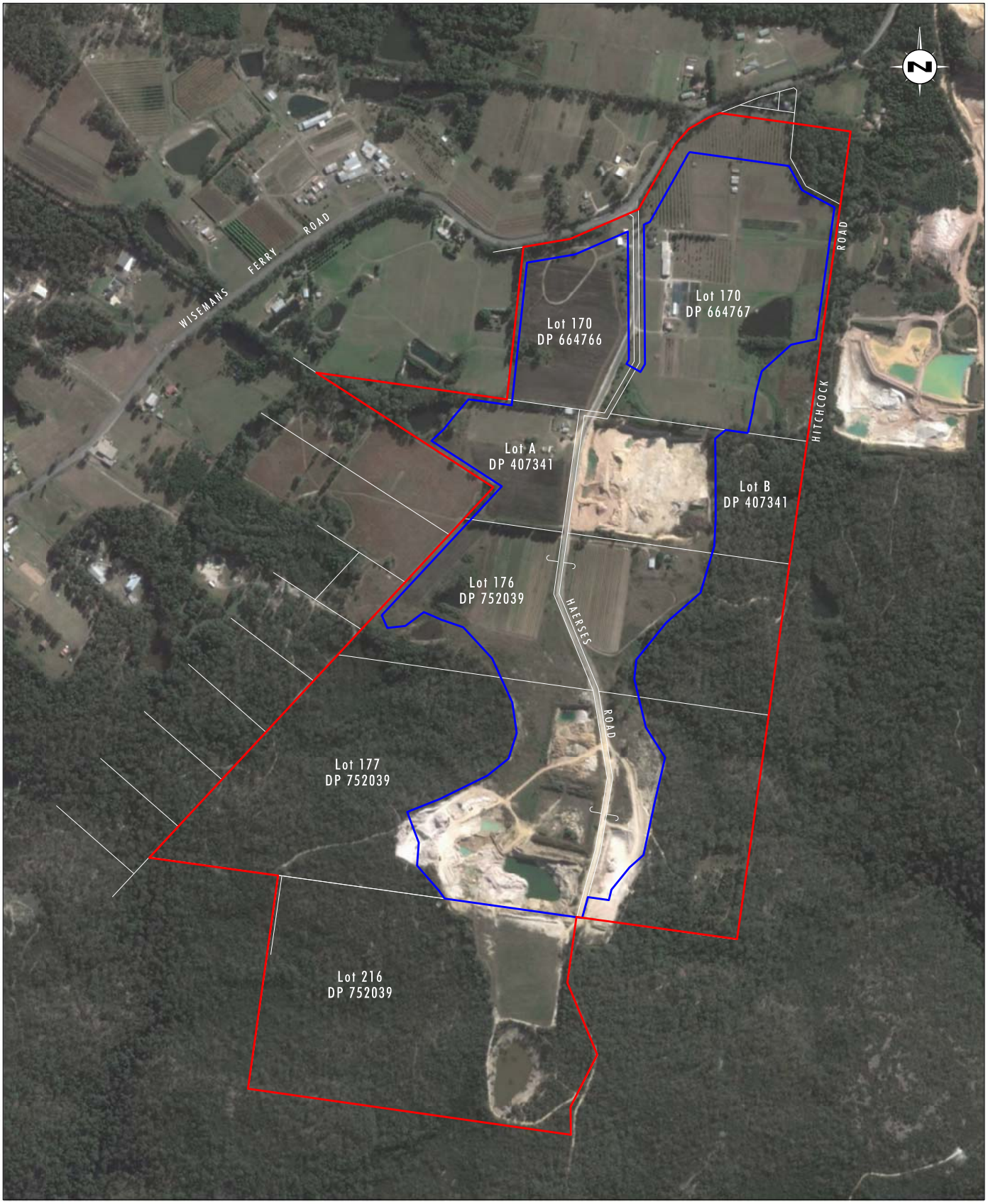

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area

FIGURE 1.2

Haerses Road Quarry Site

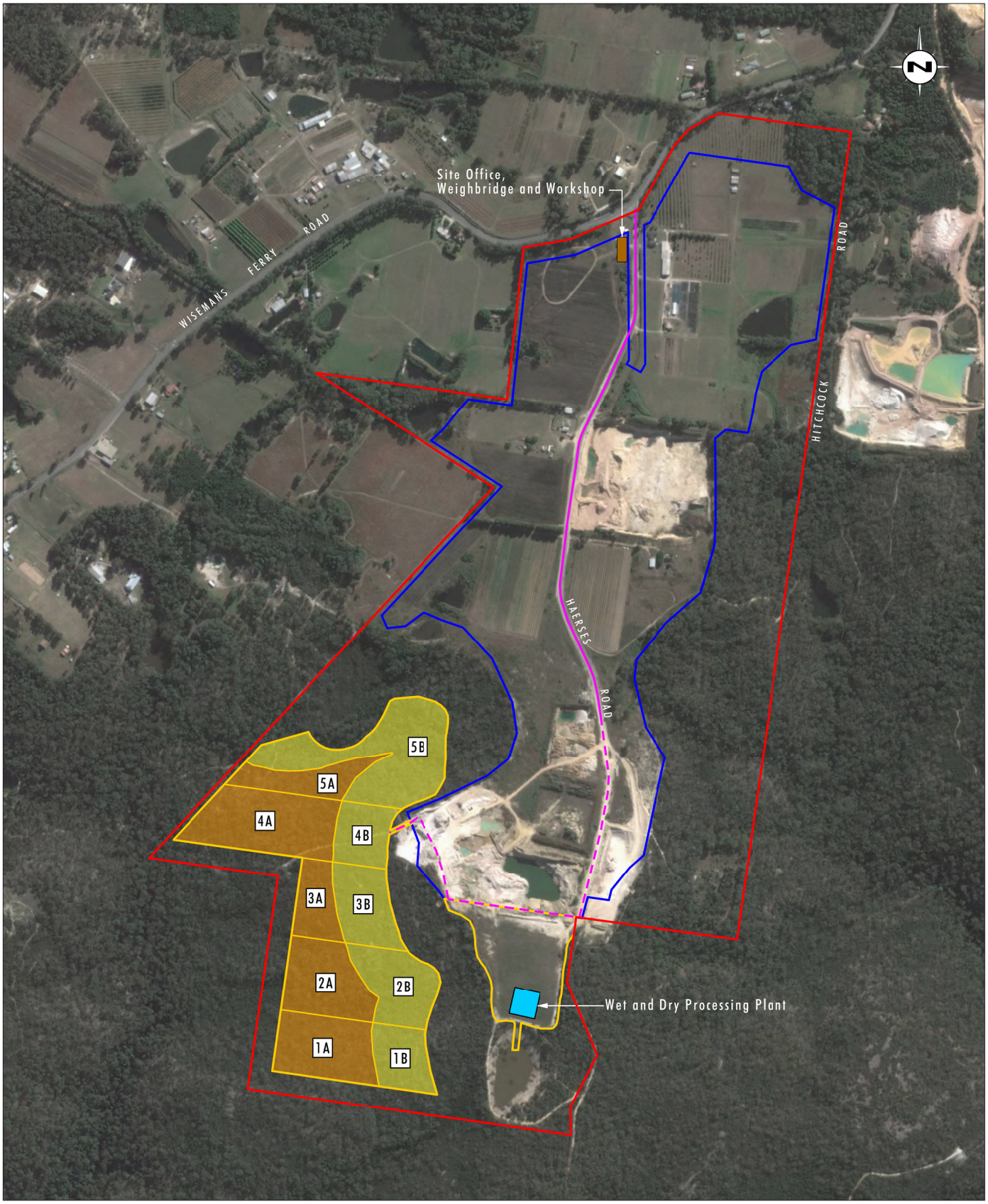

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Proposed Extraction Area A
- Proposed Extraction Area B
- [1] Extraction Cell Number
- Site Office, Weighbridge and Workshop
- Wet Processing Plant
- Indicative Unsealed Haul Road
- Sealed Haul Road

FIGURE 1.3

Proposed Modification

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20160922 10.28

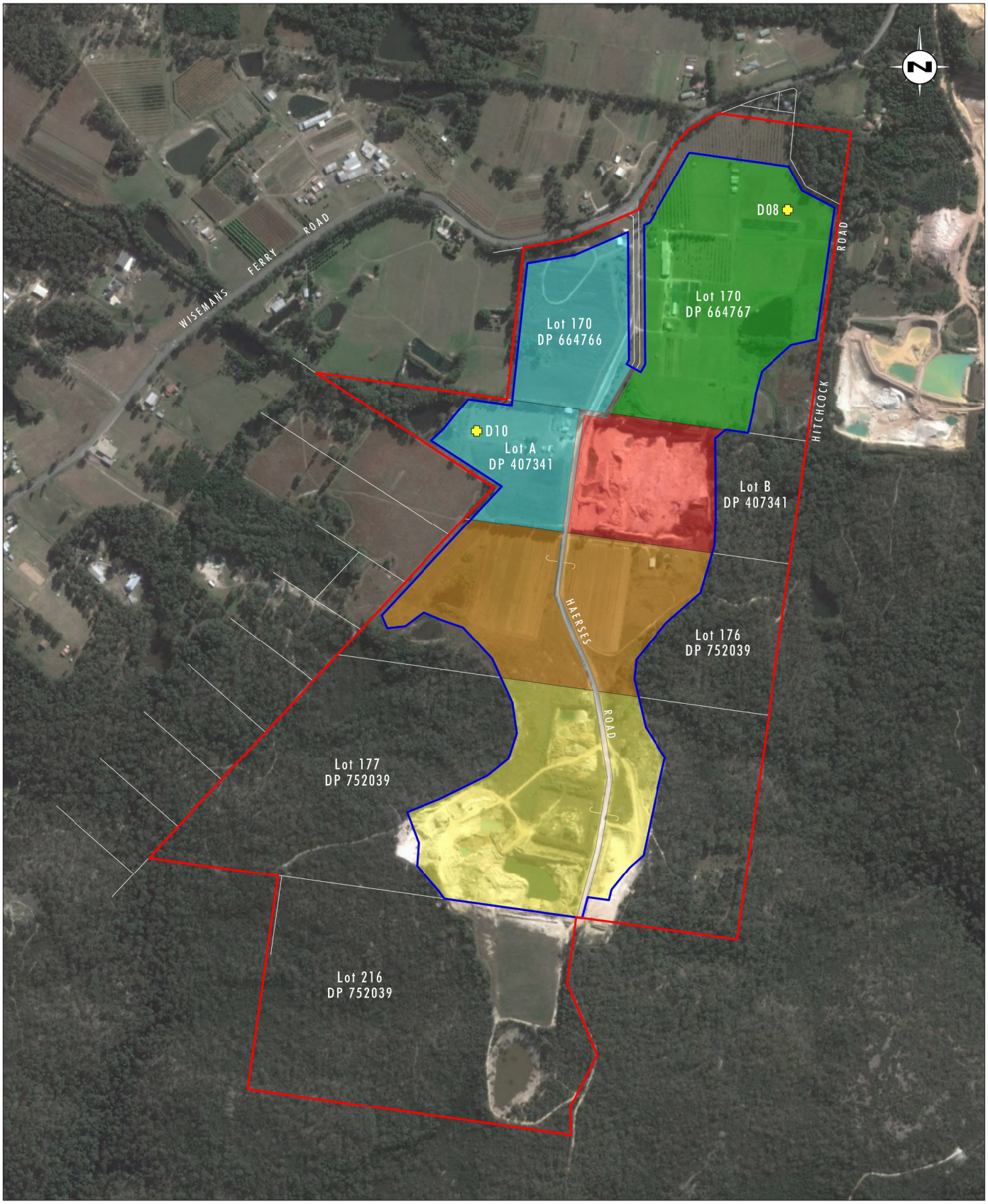

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Stages
- Proposed Extraction Area Stage 1
- Proposed Extraction Area Stage 2
- Proposed Extraction Area Stage 3
- Proposed Extraction Area Stage 4
- Proposed Extraction Area Stage 5
- Static Dust Gauge

FIGURE 1.4

Haerses Road Quarry
Approved Stages

File Name (A4): R05/3479_063.dgn
20160922 10.30

There are two key aquifers of relevance to the Modification: the Maroota Tertiary Sands Groundwater Source (MTSGS) with occurs in the tertiary sand deposit; and the Sydney Central Basin Groundwater Source (SCBGS) which occurs in the Hawkesbury Sandstone. The wet weather elevation of the SCBGS (and extraction depth) is lower than the wet weather elevation of the MTSGS, which is perched some 40 metres above the regional aquifer of the SBCGS.

The predominant land uses within the vicinity of the site are rural residential properties along Wisemans Ferry Road and Old Northern Road with bushland associated with the Deerubbin Local Aboriginal Land Council (LALC) property to the south and east of the site.

The site is located on the south western outskirts of the rural community of Maroota, which supports a small rural residential population of 291 people (Census, 2011). The Maroota Public School is located approximately 1.6 kilometres to the north of the site. Other small rural communities located in the region include South Maroota, which is located approximately 4 kilometres south west of the site and Wisemans Ferry, which is located approximately 9 kilometres north of the site.

Haerses Road Quarry is a substantial distance from any major residential areas. The closest being Windsor located approximately 21 kilometres to the south west, Rouse Hill located approximately 24 kilometres to the south south-west and Hornsby located approximately 27 kilometres to the south east.

The land uses in the local area include fruit orchards, market gardens, quarries, grazing of livestock and rural residential properties. The surrounding region is a significant area for quarrying, with at least five sand/sandstone quarries located within the local area. Specifically, the site is located in proximity to the following sand/sandstone quarries:

- Maroota Sandstone Quarry Australia – located approximately 5.4 kilometres to the west of the site
- P.F. Formation, Pits 3 and 5 – located approximately 4.0 kilometres to the north of the site
- P.F. Formation, Old Telegraph Road Sand Extraction – located 2.5 kilometres to the north east of the site
- Dixon Sand, Old Northern Road Quarry – located approximately 2.0 kilometres to the north of the site
- Hodgson Quarries and Plant, Roberts Road Quarry – located approximately 1.0 kilometres to the east north-east of the site
- P.F. Formation, Hitchcock Road Sand Extraction – located adjacent to the northern part of the site on the eastern side.

The site is located within the catchment of Little Cattai Creek with surface runoff from the Modification area draining to the west to a tributary of Little Cattai Creek. To the south of the site Little Cattai Creek flows in a southerly then westerly direction before joining the Hawkesbury River approximately 11 kilometres to the south west of the site.

The topography of the Hearses Road Quarry site consists of a north/south aligned ridge on which Haerses Road is located with the land sloping away to the east and west (refer **Figure 1.5**). Within the site Haerses Road is at an elevation of approximately 190 metres sloping away to the west to the lowest point within the site of approximately 110 metres.

1.2.1 Existing Conservation and Management Areas

As part of the conditions of consent for the modified Old Northern Road Quarry, Dixon Sand identified a biodiversity offset area within the south eastern portion of the Haerses Road Quarry site. The biodiversity offset area, shown in **Figure 1.6**, has been approved by OEH and is 8.7 hectares in size. The Modification will not encroach on this area.

1.3 Land Ownership

Dixon Sand owns all of the land within the Haerses Road Quarry site, being Lot 170 DP 664766, Lot 170 DP 664767, Lots A and B DP 407341, and Lots 176, 177 and 216 DP 752039. The Modification area is entirely contained within the existing site owned by Dixon Sand. The Modification would not require any works outside of the existing site boundary.

The land immediately surrounding the site generally consists of privately owned rural residential lots, with other quarrying operations to the north, east and west and the Deerubbin LALC property (formally the Maroota State Forest) to the south and west.

1.4 Project Team

This EA was prepared by Umwelt on behalf of Dixon Sand. Studies contributing to and included in the EA were undertaken by a number of technical specialists, including:

- Aboriginal Cultural Heritage Assessment – Umwelt
- Air Quality Assessment – Pacific Environment
- Ecological Impact Assessment – Umwelt
- Groundwater Assessment – Australian Groundwater Technologies
- Traffic Impact Assessment – SECA Solutions.

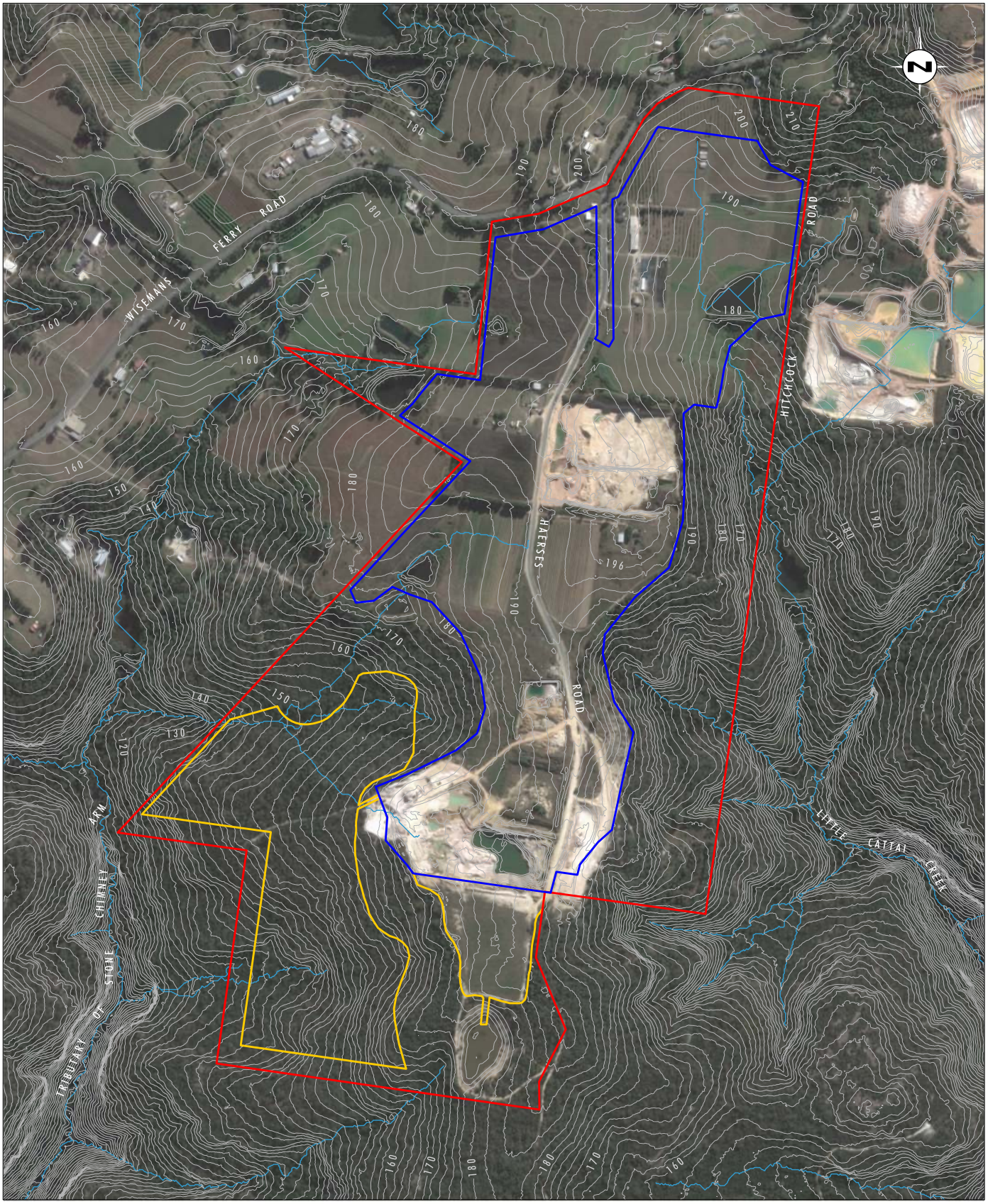

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)
Note: Contour Interval 2m

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Drainage Line

FIGURE 1.5

Haerses Road Quarry
Topography and Drainage Lines

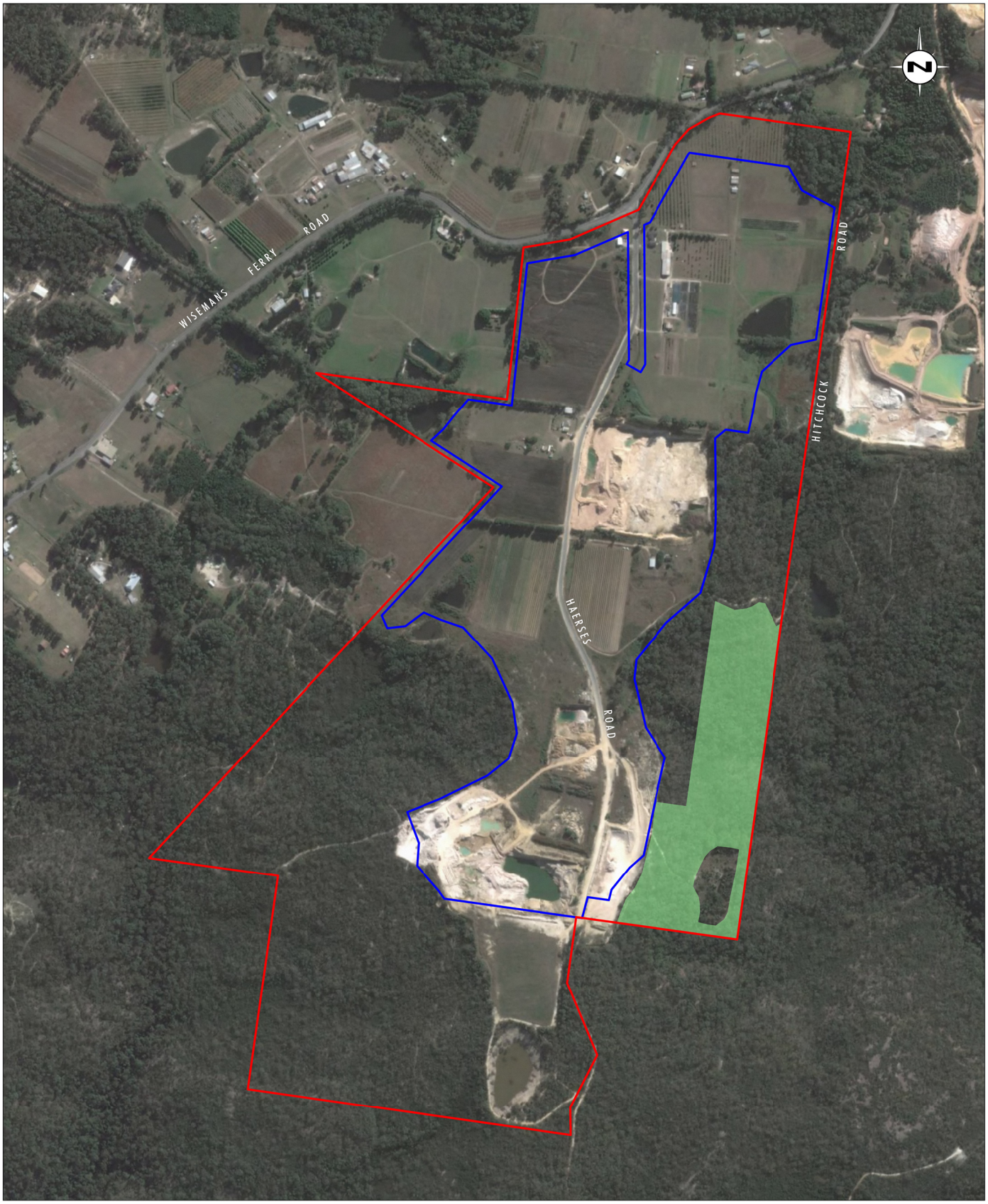

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Biodiversity Offset Area for Old Northern Road Quarry

FIGURE 1.6

Biodiversity Offset Area

1.5 Environmental Assessment Structure

The EA has been prepared in accordance with the EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (refer to the EA Statement of Authorship in **Appendix 1**). An overview of the structure of this EA is provided below.

The Executive Summary provides a brief overview of the Modification and the major outcomes of the EA.

Section 1.0 introduces the Modification, outlines the background, provides a summary of the key details of the Modification, and outlines the EA project team and the EA structure.

Section 2.0 contains a description of the existing and approved site operations, including current consents and other statutory approvals.

Section 3.0 provides a detailed description of the Modification, as well as alternatives considered in the design of the Modification.

Section 4.0 outlines the planning and approvals context for the Modification, including the applicability of Commonwealth and State legislation.

Section 5.0 describes the stakeholder consultation and details the environmental and community issues identified as part of this process for consideration in the EA.

Section 6.0 identifies the key environmental and community issues and provides analysis and assessment of these issues relevant to the Modification, including the project specific and cumulative impacts.

Section 7.0 sets out a summary of the environmental management measures (including monitoring) proposed to be adopted throughout the life of the Modification in order to mitigate potential impacts.

Section 8.0 summarises the key conclusions arising from the detailed environmental assessment, discusses the justification for the Modification and sets out how it is consistent with the principles of ecologically sustainable development.

Section 9.0 lists references cited in the EA.

2.0 Existing Operations

2.1 Existing Approvals

In July 2005, Dixon Sand lodged a development application and accompanying Environmental Impact Statement (EIS) (ERM, 2005) with the then Department of Infrastructure, Planning and Natural Resources (DIPNR) (now DP&E) for determination by the Minister for Planning. The project was classed as a State Significant Development. Development Consent was granted for the project on 14 February 2006 approving the sand quarry to operate at up to 250,000 tpa over an operational period of 25 years (until 14 February 2031).

Since the original approval, there have been no modifications to this consent.

Dixon Sands also hold several other environmental and operational approvals which apply to Haerses Road Quarry. These are outlined in **Table 2.1**.

Table 2.1 Legislation and Policies Relevant to the Quarry

Planning Provisions	Comments	Approval Details
Protection of the Environment Operations Act 1997	Dixon Sand holds an Environment Protection Licence (EPL) for the existing operations.	EPL No. 12513
Roads Act 1993	Dixon Sand obtained agreement from The Hills Shire Council for upgrade works to Haerses Road which were required prior to commencing operations at the quarry.	Section 138 of Roads Act

2.2 Approved Operations at Haerses Road Quarry

The development consent provides for the operation of a sand quarry with total extraction of 7 million tonnes from the site over 25 years at a rate of 250,000 tonnes per annum (tpa).

Key components of the approved operations include:

- undertaking extraction in five stages, with each stage being progressively extracted and rehabilitated with the exception being Stage 1, which is the first stage and will remain operational for the life of the quarry
- progressively extracting and reinstating Haerses Road, which runs through the site, so that access is maintained during the life of the quarry
- removing coarse rejects on site using a mobile screen
- hauling of 190,000 tpa of screened sand to Dixon Sand's nearby Old Northern Road Quarry
- hauling of 60,000 tpa of screened sand direct to local and regional markets

- using facilities and land at the Old Northern Road Quarry for sand processing and tailings disposal
- rehabilitating the site to class 4 agricultural land.

The approved operation hours for all quarry activities is Monday to Saturday 7am to 6pm. Vehicle access to the site and sand loading into vehicles is also permitted 6am to 7am Monday to Saturday. There is no work at any time on Sundays or public holidays.

The quarry currently employs four full time staff.

The approved extraction area is shown in **Figure 1.2**. The quarrying process used at Haerses Road Quarry consists of several principal stages as follows:

- clearing and topsoil stripping (stockpiling or using vegetation for rehabilitation as required)
- overburden removal and emplacement
- quarrying using front end loader and dozer to load material to either truck or mobile screen
- processing the extracted sand through a mobile screen to remove oversize material
- transport of material to Old Northern Road Quarry for processing or direct to market
- progressive rehabilitation of the quarry pit and other areas affected by quarrying operations.

2.3 Existing Environmental Management System

Haerses Road Quarry has an established environmental management system (EMS) which comprises of an Environmental Management Strategy, a range of environmental management plans (EMPs) and an environmental monitoring program. The Strategy provides the strategic context for the environmental management of the quarry, while the EMPs provide detail on the management of key environmental issues. The EMS and EMPs have been developed in accordance with the conditions of the Hearses Road development consent.

As the Modification would be a continuation of the existing Haerses Road Quarry operations, ongoing implementation of the Haerses Road Quarry EMS would be the most efficient and effective way of managing site operations. The existing EMS will therefore be updated to reflect the changes associated with the Modification and implemented for the ongoing operations, pending approval of the Modification.

The key existing EMPs for Haerses Road Quarry that will assist in the management of operations undertaken as part of the Modification include:

- Noise Management Plan – provides a framework for the management of noise including procedures, monitoring and reporting requirements
- Air Quality Management Plan – provides a framework for the management and monitoring of dust, particulate matter and total suspended particulates including procedures and reporting requirements
- Groundwater Management Plan – provides a framework for the management of groundwater including depth of extraction, groundwater quality monitoring and reporting requirements

- Site Water Management Plan – provides an overarching framework for the management of water on site, including surface water management and monitoring and erosion and sediment controls

- Rehabilitation and Landscape Management Plan – outlines the approach to quarry rehabilitation and describes in detail the rehabilitation processes and the approach to managing the ecological and landscape values of the site.

Details of how these plans will be updated and applied to the Modification, are discussed in the relevant environmental assessment section of this report (refer to **Section 6.0**).

3.0 Description of the Proposed Modification

3.1 Need for the Modification

As a result of the recent increase in demand for medium to coarse grain sands and specialist sands in the Sydney market, Dixon Sand is seeking to modify the existing Haerses Road Quarry development consent to increase the extraction area and to increase the volume of sand sold direct to market from the site. There is no proposal to increase currently approved production rates and associated traffic movements to and from site.

The modified quarry would provide a long-term, high quality supply of construction materials into the Sydney local and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and will contribute to the security and economic viability of the Sydney construction industry along with supply to other key sand markets.

3.2 Key Features of the Modification

The Modification involves extracting friable sandstone in addition the currently approved extraction of the tertiary sand deposit and increased on site processing capacity. Other key elements of the proposed modifications include:

- new 30 year quarry life from 2016 to 2046 based on the extent of available resource
- increasing the extraction area by approximately 19 hectares to allow extension into the friable sandstone resource within Lots 177 DP 752039 and 216 DP 752039 (refer to **Figure 1.3**). The friable sandstone would be extracted using similar methods and equipment as currently used at the site, being a dozer, excavator, trucks and a loader
- addition of mobile crushers (one jaw crusher and one rotary crusher) to break sandstone clumps prior to screening using the existing dry screening plant
- addition of a mobile wet plant to wash the crushed friable sandstone and tertiary material to remove clay fines from the sand product. This will allow processing at the Hearses Road site as opposed to necessarily having to transport it to the Dixon Sand's Old Northern Road Quarry for processing
- importation of up to 100,000 tpa of clean recycled Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM). The VENM and ENM would be reprocessed by blending with product from either the Haerses Road Quarry or Old Northern Road Quarry prior to sale. VENM or ENM would also be used to achieve the final landform where there is a shortfall in overburden or fines from the washing process
- utilise the existing approved traffic movements between Old Northern Road and Hearses Road quarries to allow for blending of speciality sands, including VENM and ENM. No new traffic movements would be generated by the proposed modification and there would be negligible change to traffic generation between quarries as a result of the modification
- use of mobile washing and processing plant on site, utilising water from existing water licence provisions
- installation of additional detention basins and associated water management infrastructure

- establishment of site office, workshop and weighbridge
- progressive rehabilitation of the proposed additional extraction area.

Table 3.1 provides a comparison between the approved quarry and the Modification. The Modification disturbance area is shown in **Figure 1.3** and consists of the proposed extraction area and the cleared area incorporating the wet and dry processing area which includes temporary stockpiling and truck turning areas.

Table 3.1 Comparison of the Currently Approved Haerses Road Quarry and the Modification

Quarry Components	Currently Approved	Proposed Modifications
Quarry life	Quarry operations to cease 14 February 2031	Additional fifteen years. Quarry operations to cease 2046
Limit on production	250,000 tpa	No change
Maximum transport of product	To Old Northern Road Quarry	
	190,000 tpa	No change
	Direct to market	
	60,000 tpa	Increase flexibility to allow all of the 250,000 tpa to be delivered direct to market
Truck movements	28 truck movements into Haerses Road per day (10 movements allowed between 6am and 7am). 28 truck movements out of Haerses Road per day (0 – 7 left hand turns, 21 – 28 right hand turns).	No change to inbound movements. Flexibility for up to 28 left hand turns out of Haerses Road (product direct to market).
Total disturbance footprint	As shown on **Figure 1.2** (approximately 52 hectares)	As shown on **Figure 1.3** No change to approved tertiary sand extraction area. Increase of extraction area of 19 hectares to extract friable sandstone deposit within 5 cells to be opened and rehabilitated progressively. An additional 3.5 hectare cleared area will be used as the wet and dry processing area including temporary stockpiling and truck turning areas.
Overburden	Used for acoustic barriers or stockpiled and used to fill voids	No change.
Importation of material	Not included in approved operations	Receival of up to 100,000 tpa of clean recycled sands (VENM, ENM) for reprocessing and sale using existing truck movements

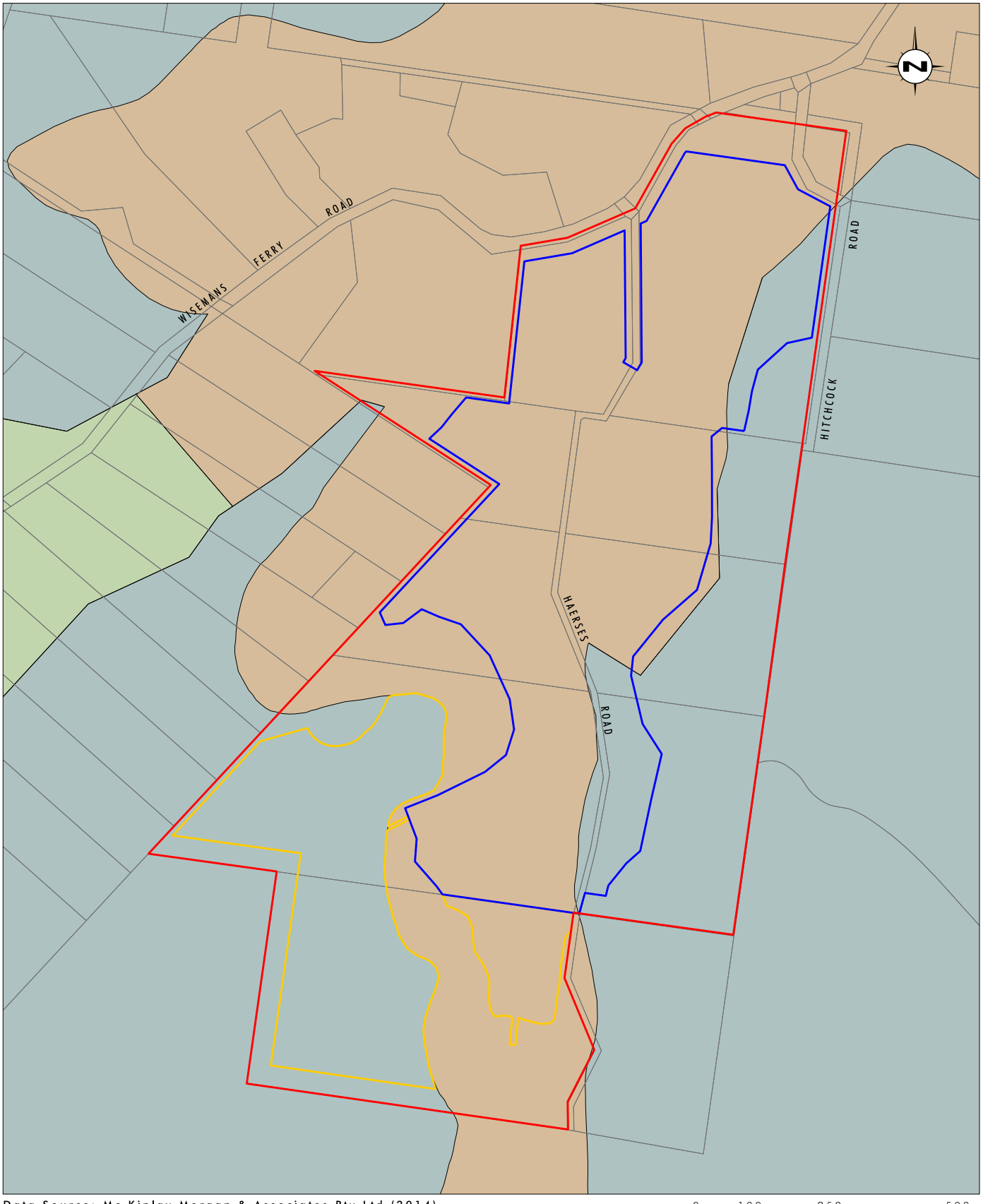
Quarry Components	Currently Approved	Proposed Modifications
Infrastructure	Haerses Road is key haul road with existing dams used for water supply	No change to haul road and water supply. The existing house immediately to the south east of the intersection of Haerses Road and Wisemans Ferry Road to be converted to site office. Ancillary to this, construction of site workshop, weighbridge and gravel car parking area (8 staff plus 4 visitor spaces). See Table 3.2 for more detail.
Equipment	Front end loader (1), 40 tonne Excavator, 30 tonne trucks (2), water cart (1), mobile dry screen, dozer (periodically), grader (irregularly), service vehicle (irregularly)	Additional mobile jaw and rotary crushers and wet processing plant
Hours of operation	Monday to Saturday 7am to 6pm. Vehicle access and sand loading 6am to 7am Monday to Saturday. No work on Sundays and public holidays	No change
Employment	Equivalent to two people full time	Up to eight people full time

3.3 Geology and Target Resource Description

Haerses Road Quarry currently quarries a tertiary deposit of fluvial and eluvial sediments that produce sand products that are suited for use as concrete and specialty sands. This sand deposit occurs along a ridgeline which broadly follows the alignment of Haerses Road (refer to **Figure 3.1**). The sand deposit sits on top of Hawkesbury Sandstone which was deposited in the Triassic and is a massive, homogeneous quartz arenite with a fine to coarse matrix (Bureau of Mineral Resources, 1961). As shown on **Figure 3.1**, the Hawkesbury Sandstone also surrounds the tertiary sand deposit on the site.

The Hawkesbury Sandstone is the target resource of a number of the local sandstone quarries including Dixon Sand's Old Northern Road Quarry and is the target of the additional quarrying area sought as part of the Modification. This deposit is well understood in the Maroota area and produces a range of suitable sand and sandstone products.

Based on an extraction area two metres above the wet weather groundwater level there is approximately 15 million tonnes of friable sandstone within the proposed 19 hectare extraction area. This comprises approximately nine million tonnes within Extraction Area A and six million tonnes within Extraction Area B (the 100 metre buffer zone of the MTSGS).



Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014), Mineral Resources NSW, December 2003

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Tertiary (Sand, silt, clay & gravel)
- Bringelly Shale, Minchinbury Sandstone, Ashfield Shale
- Hawksbury Sandstone

FIGURE 3.1

Geology

File Name (A4): R05/3479_057.dgn
20160907 11.37

3.3.1 Groundwater Resources and Wet Weather Groundwater Elevation

A key driver for the design of the additional extraction area was avoidance of impacts on groundwater. There are two key aquifers of relevance to the Modification: the Maroota Tertiary Sands Groundwater Source (MTSGS) with occurs in the tertiary sand deposit; and the Sydney Central Basin Groundwater Source (SCBGS) which occurs in the Hawkesbury Sandstone.

Groundwater monitoring data was used to establish groundwater elevations for the MTSGS, using data since 2005, and for the SCBGS using data since 2011. The highest recorded water level measured in each bore from the monitoring network was used to determine the maximum extraction depth. The maximum extraction depth is set at an elevation of two metres above the wet weather groundwater level.

The wet weather elevation of the SCBGS (and extraction depth) is lower than the wet weather elevation of the MTSGS, which is perched some 40 metres above the regional aquifer of the SBCGS. The potential for groundwater seepages from the MTSGS to the proposed extraction cells in the Hawkesbury Sandstone will be managed by the adoption of a 100 metre buffer from the western boundary of the MTSGS. No extraction would be undertaken within the 100 metre buffer of the MTSGS until two additional monitoring bores within the western margin of the MTSGS have been established and monitoring shows that quarrying can be undertaken in this area without impacting on the MTSGS. The decision to commence quarrying in this area will be undertaken in consultation with DPI Water and with the approval of DPE. The proposed buffer zone is shown on **Figure 6.1** and on a cross section of the site (**Figure 6.2**). The buffer zone consists of the low permeability Hawkesbury sandstone.

The maximum extraction depth within the friable sandstone resource of the proposed extraction area, based on the wet weather elevation of the borehole network of the site is between 118.15 and 133.5 metres Australian Height Datum (mAHD) from east to west respectively.

3.4 Conceptual Quarry Design

The Modification does not involve any changes to the approved extraction area or process for the tertiary sand deposit approved to be quarried at Hearses Road Quarry. The proposed additional extraction area will be quarried concurrently with the existing tertiary deposit, however, as the same plant and equipment would be used for both the existing approved extraction area and the proposed extraction area, extraction operations would only ever occur within either the existing approved extraction area or within the proposed extraction area, never both at the same time. For this reason the maximum production from Hearses Road Quarry is proposed to remain at the currently approved 250,000 tpa.

As discussed in **Section 3.3.1**, avoidance of impacts on groundwater was a key design criteria for the Modification and the initial extent of the conceptual quarry pit design was modified in response to groundwater investigations and information from Department of Primary Industries (DPI) Water clarifying the extent of the MTSGS. The eastern extent of the proposed modification extraction area was reduced to avoid the underlying MTSGS. Following ecological investigations, the proposed extraction area was further revised to avoid impact on an endangered ecological community, including provision of a buffer area.

The proposed additional extraction area is approximately 19 hectares in size, inclusive of the 100 metre buffer to the MTSGS, and would be extracted progressively in five cells (**Figure 1.3**) from south to north. Initially the 'A' portion of each cell which is outside of the 100 metre buffer of the MTSGS would be fully extracted and then extraction of the 'B' portion of the cell would only commence if groundwater monitoring results indicate this could be undertaken with no impact to the MTSGS. The friable sandstone would be extracted using similar methods and equipment as currently used at the site, being a dozer, excavator, trucks and a loader. The dozer would be used to rip the friable sandstone, a process which is not currently required within the existing Tertiary sand deposit at the site.

Cell 1 would be extracted with material hauled to the wet and dry processing plant location. Upon completion of Cell 1, the pit excavation would be used as a silt/sediment storage dam. This would occur within the first five years of operation of the Modification, subject to resource demand. The wet and dry processing plant would be installed within the existing cleared area to the east of the proposed extraction pit (refer to **Figure 1.3**).

The wet and dry processing plant would be located at the furthest point practicable from sensitive receivers while being in proximity to the existing dam for water supply. The wet processing plant would be operated once the silt/tailings emplacement area within Cell 1 is installed to provide for emplacement of fines generated by the washing process. Tailings from the wet processing plant would be emplaced in cells in the extracted area and progressively dried and rehabilitated to achieve the final landform in the extracted cells.

Extraction would continue in a similar fashion in a south to north direction for the remainder of the cells. Extraction in Cell 2 would commenced following completion of extraction in Cell 1. The final landform levels for Cell 1 would be achieved using tailings from the wet processing plant from the extraction of Cells 1 and 2 as required. The silt pond in Cell 1 would be capped and rehabilitated using stockpiled overburden and topsoil.

Once the final landform levels are established in Cell 1, vegetation from Cell 3 would be translocated to Cell 1 to achieve final rehabilitation. Extraction in Cell 4 would not commence until rehabilitation in Cell 1 was complete. This process would continue so that cells are progressively rehabilitated south to north in sequential stages.

3.5 Site Infrastructure

The proposed changes to the approved quarry infrastructure include some additional plant and equipment and converting an existing dwelling into a site office with associated weighbridge and workshop. Through the quarry concept design process the opportunity was identified to incorporate additional plant and equipment to reduce the need for double handling of product when material is transported from Haerses Road Quarry to Old Northern Road Quarry for processing prior to transport to market. Currently much of the sand extracted from the site is taken by truck to the Old Northern Road Quarry for processing resulting in numerous truck movements between the two quarries (passing the Maroota town and Maroota Public School) and double handling of materials. The addition of processing plant at Hearses Road Quarry will allow for a greater proportion (and potentially all) product to be delivered direct to market to significantly reduce truck movements through Maroota and Maroota Public School and provide for significant operational efficiencies, whilst not changing the total number of truck movements from the site.

The proposed changes to the site infrastructure are identified in **Table 3.2**. As the Modification is implemented, some further minor refinements of the layout of the indicative site infrastructure may occur as part of the engineering design and construction process, however, these minor refinements will not result in changes to the components, overall location or impacts of the site infrastructure. Further detail on the key changes proposed is provided in **Sections 3.4.1** to **3.4.5**.

Table 3.2 Proposed Modifications to Haerses Road Quarry Site Infrastructure

Project component	Details of Modification
Site Access	No change
Unsealed haul roads	Additional haul roads will be constructed as required from the five extraction cells to Haerses Road. **Figure 1.3** shows the indicative alignment of the haul roads.
Mobile screen	Currently used on site as part of approved operations. To be used at the wet and dry processing plant area (refer **Figure 1.3**).
Additional plant and equipment	• Mobile jaw crusher to break up hard patches of sandstone rock fragments into sand (on an intermittent basis where required) • Mobile rotary crusher to break up hard patches of sandstone rock fragments into sand (on an intermittent basis where required) • Basic wet processing plant consisting of cyclone tanks and pumps. The mobile crushers will typically be located adjacent to the wet processing area. The wet processing plant will be located in cleared area to the east of the proposed extraction area (**Figure 1.3**).
Water management system	Three additional sediment basins and associated drains.
Site office	An existing dwelling on Haerses road is currently used as the Haerses Road site office. The existing dwelling within the northern part of the site, located immediately to the south west of the intersection of Haerses Road and Wisemans Ferry Road, will be converted to a site office with amenities for workers. This dwelling currently has electrical and sewerage connection.
Workshop	A new workshop will be constructed adjacent to the site office (current dwelling) to allow equipment maintenance to be undertaken on site.
Weighbridge	A weighbridge will be constructed adjacent to the site office and workshop.

3.5.1 Unsealed Haul Roads

The haul roads required to transport material from the five cells of the proposed extraction area to the wet processing plant or onto Haerses Road would be constructed as needed as extraction progresses from Cell 1 through to Cell 5. The haul roads would be unsealed, two way gravel roads incorporating drainage design to ensure runoff is directed to controlled areas. The haul roads would be managed for dust suppression using the water cart on an as needs basis.

3.5.2 Mobile Screen

The existing mobile screen that operates within the approved extraction area would also be utilised for material from the proposed extraction area. The screen will be moved between the approved extraction area and the wet and dry processing plant location shown in **Figure 1.3** as required.

3.5.3 Additional Plant and Equipment

The friable sandstone resource within the proposed extraction area may require crushing prior to screening which necessitates the addition of both jaw and rotary crushers. The crushers will be located at the wet and dry processing plant location (refer **Figure 1.3**) with material to be hauled from the pit to the processing area for crushing, screening and washing.

3.5.4 Water Management System

The proposed approach to the water management system for the Modification is consistent with the current water management strategies and will utilise the majority of the infrastructure of the existing water management system with the addition of three new sediment basins and associated drains as required.

As part of the Modification, the following improvements to the water management system are proposed:

- three additional sediment basins located in the south west, west and north west corners of the proposed extraction area to manage dirty water runoff from the stages of the Modification as extraction progresses
- additional dirty water drains at the boundaries of the extraction areas to assist in directing dirty water to the appropriate sediment basins during all phases of the extraction process
- additional clean water drains to intercept runoff from the upslope catchment and convey runoff around the disturbed areas.

The proposed drains and sediment basins will assist in managing upslope runoff from the clean catchment areas upslope of the existing water management system. The additional quarry pit will incorporate a sump so that dirty water can be collected and recycled.

3.5.5 Site Office, Workshop and Weighbridge

A site office, workshop and weighbridge are proposed in the northern part of the site immediately adjacent to Haerses Road (refer **Figure 1.3**). The Modification would allow greater processing of product within the Haerses Road site and a larger proportion of product to be sold direct to market from the site. To facilitate this, a site office with amenities for staff is required. Currently any maintenance of plant and equipment is undertaken at the Old Northern Road Quarry site. The proposed workshop will allow maintenance to be undertaken at the Haerses Road site without the requirement of transporting plant or equipment to the Old Northern Road Quarry site. The workshop would be approximately 20 metres by 24 metres and constructed of Colourbond material.

The Modification would allow increased movement of product direct from the site to market. Currently product going from the Haerses Road site direct to market is weighed via a weight cell fitted to the front end loader. With the potential for a substantially greater volume of product going directly from the Haerses Road site as a result of the Modification, a weighbridge provides a far more efficient method of determining the amount of product leaving the site.

3.6 Transport of Product

The proposed Modification does not seek to alter the overall number of truck movements in and out of the Haerses Road Quarry site, but rather may alter the potential truck movement patterns in and out of the site. The proposed Modification involves the following:

- Maximum of 250,000 tpa exiting the site (no change to current consent)
- Up to a maximum of 250,000 tpa direct to market (increase from current consent of 60,000 tpa)
- Up to a maximum of 190,000 tpa to exit site to Old Northern Road site (no change to current consent)
- Up to 100,000 tpa of VENM / ENM to site for processing.

The 100,000 tonnes of VENM / ENM will be transported to the site in trucks that are currently entering the site empty to pick up a load for removal of product to either the Old Northern Road Quarry or to market.

The modification does not seek to alter the overall number of truck movements in and out of the site (28 per day), but rather seeks to alter the potential truck movement patterns which currently restrict trucks to a maximum of 7 trucks movements to the south-west (left out of Haerses Road) per day and increase this to a maximum of 28 per day. If the 28 truck movements per day turn left out of the site, there will be no trucks turning right out of the site, which is currently restricted to 28 per day maximum.

3.7 Quarry Rehabilitation and Final Landform

In accordance with Condition 22 of Schedule 3 of the Haerses Road Quarry development consent, a detailed Rehabilitation and Landscape Management Plan has been prepared for the quarry. This plan provides a detailed description of the planned approach to rehabilitation of the quarry, focusing on the rehabilitation of the approved extraction area. Aspects of the Modification that will require a revision of the rehabilitation strategy outlined in the Rehabilitation and Landscape Management Plan include the additional extraction area, the wet and dry processing area, new water management features and the overall increase to the disturbance footprint.

A key aim of the rehabilitation strategy is to provide for progressive rehabilitation of disturbed areas once activities in these areas are complete. The Rehabilitation and Landscape Management Plan provides a detailed description of the strategies that will be used to rehabilitate the areas disturbed by quarrying operations. These strategies will be applied to the modified aspects of the projects outlined above including:

- clearing and rehabilitation - cleared vegetation and topsoil from one strip would be transferred directly for use in the rehabilitation of a previously extracted strip
- topsoil management - the top 100 to 300 millimetres of soil will be stripped immediately prior to extraction and applied directly over areas to be rehabilitated. In the event that a rehabilitation area is not ready for topsoil spreading, the topsoil will be stockpiled temporarily (typically less than 12 months) away from drainage lines
- revegetation techniques and species – the approved extraction area will generally be rehabilitated to agricultural land using a pasture mix. The additional extraction area will be rehabilitated to native vegetation using local native species
- drainage lines - stands of native vegetation will be progressively re-established within the drainage lines to stabilise soil and slow runoff into dams and waterways.

The Rehabilitation and Landscape Management Plan includes a conceptual final rehabilitation plan for the quarry. A revised conceptual final rehabilitation plan for the proposed modifications to the approved quarry is included as **Figure 6.21**.

Should the proposed modification be approved, the Rehabilitation and Landscape Management Plan will be updated to incorporate the proposed modifications.

3.8 Alternatives and Justification

3.8.1 Alternatives

Initially the proposed Modification incorporated an extraction area larger than the currently proposed 19 hectares. The proposed extraction area was refined based on groundwater investigations to ensure avoidance of impacts on the MTSGS and SCBGS. The size of the proposed extraction area was further refined to assist in reducing impacts to threatened species and ecological communities within the site and to allow for the incorporation of an on-site offset area for the protection of the Coastal Upland Swamp endangered ecological community (refer to **Section 6.7.2**).

The other key alternative that requires consideration in regard to the proposed Modification is the 'do nothing' alternative, that is, proceeding with the quarry as currently approved and not proceeding with the proposed Modification. This alternative is not considered desirable as this would result in a high quality resource of medium to coarse grain sands and specialist sands located near to Sydney not being available for the Sydney market which has recently seen an increase in demand for these products. It would also result in the underutilisation of a site already subject to quarrying.

It is acknowledged that the quarry could continue without the proposed changes, however, the changes provide benefits to the Sydney region construction sand market and they can be undertaken without resulting in significant environmental impacts on the community as identified in this environmental assessment. In these circumstances, it is considered that the 'do nothing' alternative is not an appropriate alternative.

3.8.2 Justification for the Proposed Modification

The quarry will provide a long-term, high quality supply of construction sand into the Sydney region market. This supply is needed to meet the increased demand within Sydney and will contribute to the security of supply to the Sydney region sand market. There is a shortage of sand in the Sydney market due to the recent closure of sand quarries such as Penrith Lakes as well as other quarries such as Kurnell not being extended. Part of the shortfall can be sourced from regional quarries around Newcastle and the Southern Highlands however these locations have associated increased transport distances and associated haulage costs and road safety issues. The extension of the quarrying area and life of operation of the Haerses Road quarry would provide a local resource close to the Sydney metropolitan market and transport links. A high level resource assessment estimates that within the 19 hectare expansion area there is approximately 15 million tonne of friable sandstone.

The Haerses Road Quarry will also provide direct employment for the equivalent of 8 full time people with flow on indirect benefits within the local community.

The proposed Modifications to the quarry will not change any of the benefits of the quarry as identified in the EIS (ERM, 2005) and as demonstrated in this EA, will not result in significant environmental impact on the community.

4.0 Planning Considerations

The following section identifies relevant State and Commonwealth legislation and discusses the application of these planning provisions to the Modification.

4.1 Commonwealth Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the primary environmental and planning regulatory instrument relevant to the Modification at a Commonwealth level. The operation of the EPBC Act and its application to the Modification is discussed in **Section 4.1.1** below.

The *Native Title Act 1993* is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. The *Native Title Act 1993* prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land.

The *Native Title Act 1993* is not directly relevant to the approval process for the Modification as the additional area consists entirely of freehold land.

4.1.1 Environmental Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, approval by the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World Heritage properties
- National Heritage Places
- Wetlands of international importance (Ramsar wetlands)
- migratory species, threatened species, critical habitats or ecological communities listed in the EPBC Act
- Commonwealth land, marine areas or reserves
- nuclear actions
- a water resource in relation to coal seam gas development and large coal mining development.

The existing operations are not subject to an EPBC approval.

The Modification does not interact with any Commonwealth land, Commonwealth marine areas, the Great Barrier Reef Marine Park and is not a nuclear action, coal seam gas development or large coal mining development. The remaining potentially relevant matters have been considered in regard to the Modification.

Those aspects of the Modification requiring consideration under the EPBC Act were referred to the Commonwealth Department of the Environment (DoE) in November 2015 to determine whether or not it was a controlled action, thereby requiring approval of the Commonwealth Minister for the Environment. On 28 January 2016, the Modification was determined to be a Controlled Action requiring approval under the EPBC Act from the Commonwealth Minister for the Environment due to its potential impact on listed threatened species and communities, including:

- *Darwinia biflora*
- Coastal Upland Swamp in the Sydney Basin Bioregion.

A copy of the determination of the Modification as a Controlled Action is provided in **Appendix 2**. The assessment path for the Project is under the bilateral agreement between the Commonwealth and NSW Governments.

4.2 State Legislation

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act is administered by DP&E and by local government and is the primary legislation governing environmental planning and assessment for NSW. DP&E is responsible for State Significant Development which includes Haerses Road Quarry and is therefore the responsible agency for the Modification.

The objectives of the EP&A Act relevant to the Modification encourage:

- the proper management, development and conservation of natural and artificial resources
- the promotion and co-ordination of the orderly and economic use and development of land
- the protection of the environment
- ecologically sustainable development.

DA 165-7-2006-5 was granted under Part 4 of the EP&A Act in February 2006 and classified as State Significant Development. As the original consent was deemed a State Significant Development and granted under Part 4 of the EP&A Act during the transitional Part 3A arrangements, section 75W of the EP&A Act is available to modify DA 165-7-2006-5, as discussed below.

It is proposed to modify the existing development consent under the transitional arrangements applying with respect to Section 75W of the EP&A Act, which was repealed on 1 October 2011. Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) prescribes how, in certain circumstances, a development consent can be modified under Section 75W of the EP&A Act. Clause 8J(8) relevantly provides:

> (8) For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:
>
> (c) a development consent granted by the Minister under Part 4 of the Act (relating to State Significant Development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,
>
> ...
>
> The development consent, if so modified, does not become an approval under Part 3A of the Act.

The existing Haerses Road Quarry was granted under Part 4 of the EP&A Act in February 2006 and was subject to the savings and transitional provisions contained in clause 89 of Schedule 6 of the EP&A Act.

Part 3A of the EP&A Act has been repealed, however, Schedule 6A, Clause 12 of the EP&A Act provides for the continued operation of Section 75W in relation to the modification of the development consents referred to in Clause 8J(8) of the EP&A Regulation. Schedule 6A, Clause 12 of the EP&A Act states:

> **12 Continuing application of Part 3A to modifications of certain development consents**
>
> Section 75W of Part 3A continues to apply to modifications of the development consents referred to in clause 8J (8) of the Environmental Planning and Assessment Regulation 2000, and so applies whether an application for modification is made before or after the commencement of this clause.

Section 75W is therefore considered the appropriate approval pathway for the Modification. The Minister for Planning is the consent authority for the Modification. This approval pathway was confirmed by DP&E in an email to Umwelt dated 25 August 2016.

4.2.1.1 Permissibility

The local environmental planning instrument relevant to the Modification is *The Hills Local Environment Plan 2012* (LEP). The LEP applies to The Hills local government area (LGA).

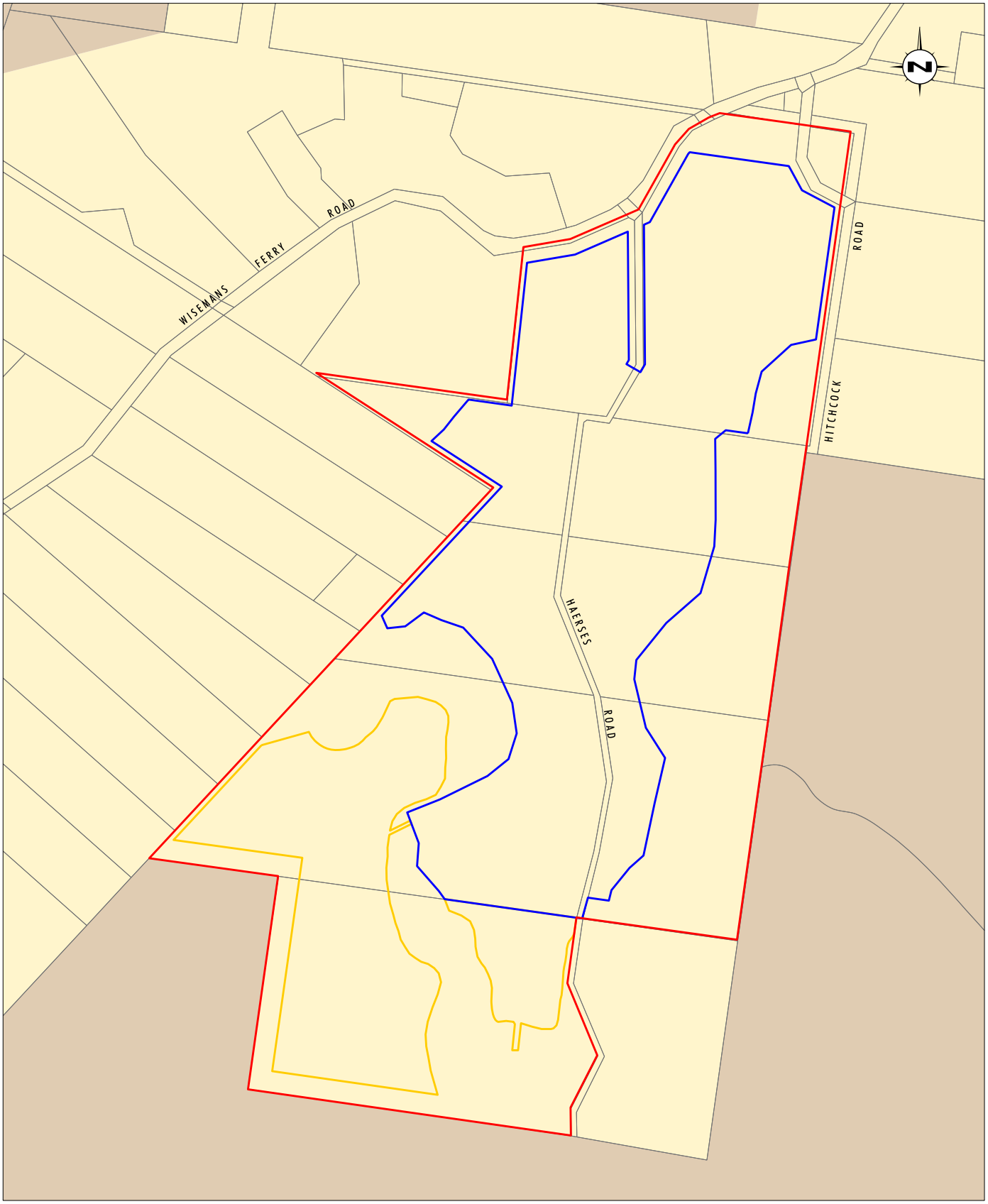
The entire site is zoned RU1 Primary Production (**Figure 4.1**). The objectives of the RU1 zone is:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area
- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones
- to facilitate the economic extraction of materials from land and the subsequent rehabilitation of that land.

Extractive industries are permissible with development consent within land zoned RU1. As the development is permissible with consent, the Minister (or delegate) can approve the carrying out of the Modification.

4.2.2 Summary of Other State Legislation

A summary of the other State Acts potentially applicable to the Modification is included in **Table 4.1**, along with an indication of which additional approvals will be required.



Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014), Mineral Resources NSW, December 2003

0 100 250 500m
1:10 000

Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- RU1 - Primary Production
- RU2 Rural Landscape

FIGURE 4.1

Zoning

Table 4.1 Summary of Other Potentially Relevant State Legislation

Act	Comments	Approval Required
Protection of the Environment Operations Act 1997	Dixon Sands holds an Environment Protection Licence (EPL No. 12513) for the Haerses Road Quarry. Should the Modification be approved, the EPL will need to be modified to accommodate the proposed changes.	Yes
National Parks & Wildlife Act 1974	Aboriginal Heritage Impact Permits (AHIPs) are required under s87 and s90 of the *National Parks & Wildlife Act 1974* for Aboriginal sites proposed to be impacted by development. The site does not contain any identified Aboriginal archaeological sites and therefore there is currently no requirement to obtain specific approvals relating to Aboriginal cultural heritage.	No
Water Act 1912	This Act has been repealed by the *Water Management Act 2000*; however, some of the licensing provisions remain in force where the water source is not covered by a water sharing plan. The Haerses Road Quarry is within an area covered by a water sharing plan.	No
Water Management Act 2000	The site falls within the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* which commenced on 1 July 2011. As such, surface water within the catchment is managed under the *Water Management Act 2000*. All water extractions from water sources (surface and groundwater) regulated by a Water Sharing Plan will require licensing under the *Water Management Act 2000* where they are in addition to extractions permitted under harvestable rights. Dixon Sand currently holds two water licences for the purpose of irrigation for the Haerses Road site. As identified in **Section 6.4** of this report the water balance indicates that external water supply is unlikely to be required, however, if in the such as supply is required, application would be made to convert the licence to the applicable use (as required). A controlled activity approval is required to authorise its holder to carry out a controlled activity in, on or under waterfront land.	Yes

Act	Comments	Approval Required
	Waterfront land is defined as the bed of any river, lake or estuary and any land within 40 metres of the river banks, lake shore or estuary mean high water mark. There are two first order creek lines which run through the Modification Area and which will be quarried through, therefore a controlled activity approval will be required for the Modification.	
Threatened Species Conservation Act 1995	A licence under this Act is not required for any activity undertaken in accordance with a development consent granted under the EP&A Act and therefore no approvals are required.	No
Heritage Act 1912	No heritage sites will be affected and no s140 or s60 excavation permits are required under this Act for works associated with the Modification.	No
Roads Act 1993	The *Roads Act 1993* determines the rights of the public and adjacent land owners to use public roads, and establishes procedures for the opening and closing of public roads. Under the Act applications are required to be made for the closure of roads and for works in road reserves. No road closures or road works are proposed as part of the Modification.	No
Crown Lands Act 1989	The Crown Lands Act provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the *Crown Land (Continued Tenures) Act 1989*. As noted above, no road closures or road works are proposed as part of the Modification and no areas of Crown land would be affected.	No
Native Vegetation Act 2003	The provisions of this Act do not apply to any activity undertaken in accordance with a development application granted for designated development under the EP&A Act and therefore do not apply to the Modification.	No

Act	Comments	Approval Required
Environmentally Hazardous Chemicals Act 1985	Under the *Environmentally Hazardous Chemicals Act 1985* a licence is required for any storage, transport or use of prescribed chemicals. Dixon Sand does not propose to store, transport or use any chemicals currently subject to a Chemical Control Order (CCO) under this Act. Should such chemicals be required during the life of the Haerses Road Quarry operations, Dixon Sand will manage the chemicals in accordance with the relevant CCO, including obtaining any appropriate licences.	No

4.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments created by the State government. The SEPPs that are potentially relevant to the Modification are discussed in the following section.

4.3.1 State Environmental Planning Polices (State and Regional Development) 2011

The State and Regional Development SEPP commenced on 1 October 2011, on the date Part 3A of the EP&A Act was repealed. The SEPP identifies development that is State Significant Development. Haerses Road Quarry, if a new proposed development, would be of a class of development listed as State Significant Development under the SEPP. As discussed in **Section 4.2.1**, as the original consent was deemed a State Significant Development and granted under Part 4 of the EP&A Act subject to the savings and transitional provisions contained in clause 89 of Schedule 6 of the EP&A Act, Section 75W of the EP&A Act is the appropriate approach to modify the existing consent.

4.3.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Extractive Industries SEPP)

The Extractive Industries SEPP regulates the permissibility and assessment requirements for mining, petroleum production and extractive industries and related development. The SEPP outlines where various extractive industry activities are permissible both with and without development consent. The SEPP also defines mining, petroleum production and extractive industries developments that are prohibited, exempt or complying developments.

Part 3 of the Extractive Industries SEPP requires specific matters to be considered in relation to development applications. These requirements are set out below:

Clause 12, extracted below, requires the consent authority to consider the compatibility of proposed developments with existing land uses in the area.

12 Compatibility of proposed mine, petroleum production or extractive industry with other land uses

Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

(a) consider:

(i) the existing uses and approved uses of land in the vicinity of the development, and

(ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and

(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and

(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

The Modification is a continuation of an existing approved operation which has been coexisting with neighbouring land uses for approximately 10 years. The key operational areas of the quarry have substantial buffer distances to sensitive surrounding land uses and the Modification, as designed, is considered to be broadly compatible with surrounding land uses. The compatibility of the Modification with surrounding land uses is considered in more detail in **Section 6.0**.

Clause 13 of the Extractive Industries SEPP requires the consent authority to consider the potential impact of proposed developments in the vicinity of an existing extractive industry operation or potential resources.

Surrounding land uses include agriculture, extractive industries and the rural residential areas of Maroota. Agricultural activities include orchards, market gardens and grazing, and are mostly restricted to the Maroota Ridge (ERM, 2005). Sand extraction has been a significant land use in the Maroota area since the 1980s. There are a number of sand quarries to the north and east of the site.

Given the distances between these extractive operations and Haerses Road Quarry, and the fact that Haerses Road Quarry is a currently approved operation, the Modification will not adversely impact upon or constrain these operations or their resources.

The Modification will not adversely impact on any known minerals or petroleum resources.

Environmental Management

Clause 14 of the Extractive Industries SEPP requires the consent authority to consider the impact of a proposed extractive industry project on natural resources and whether specific environmental management conditions should be imposed on the development if approved. The Modification's potential impact on natural resources, including those specifically referred to in Clause 14(1), (i.e. significant surface and groundwater resources; threatened species/biodiversity; greenhouse gas emissions) is addressed in detail in **Section 6.0**. Specific commitments regarding the management of potential environmental impacts are contained in **Section 7.0**, building on the controls in place for the existing Haerses Road Quarry via the development consent and management plans prepared in accordance with the consent.

Resource Recovery

Clause 15 of the Extractive Industries SEPP requires the consent authority to have regard to the efficiency of a proposed extractive industry development in terms of its ability to optimise extraction of the target resources. The Modification has been developed to facilitate the efficient recovery of extractive resources from within the proposed extraction area. This is discussed in more detail in **Section 3.0**.

Transport

Clause 16 of the Extractive Industries SEPP requires the consent authority to consider whether or not the proposed extractive industry development under consideration should be subject to conditions restricting the use of public roads for product transport or other related traffic. As detailed in **Section 3.0**, no new traffic movements would be generated by the Modification and there would be negligible change to traffic generation as a result of the proposed Modification.

Rehabilitation

Clause 17 of the Extractive Industries SEPP requires a authority determining a development application for a proposed extractive industry development to have regard to whether or not to impose specific conditions regarding the rehabilitation of land affected by the development. The areas disturbed by quarrying activity will be progressively rehabilitated as the Modification progresses. The approach to rehabilitation is dealt with in more detail in **Section 6.14**.

4.3.3 State Environmental Planning Policy 33 – Hazardous and Offensive Development

SEPP No. 33 – Hazardous and Offensive Development requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. The aim of this policy is to link the permissibility of a proposal to its safety and pollution control performance. The assessment process establishes whether the proposal is potentially hazardous or offensive and if this is not the case, SEPP 33 is not applicable.

The existing operations were determined, as part of the original approval process to not be a hazardous or offensive development. The proposed Modification will not result in any changes to the existing Haerses Road Quarry operations which would alter this classification. No further consideration of SEPP No. 33 is required.

4.3.4 State Environmental Planning Policy 44 – Koala Habitat Protection

SEPP No. 44 – Koala Habitat Protection applies to the extent that a consent authority is restricted from granting development consent for proposals on land identified as core koala habitat, without the preparation of a plan of management. There is no core koala habitat within the site therefore the further provisions of the SEPP do not apply.

4.3.5 State Environmental Planning Policy 55 – Remediation of Land

SEPP No. 55 – Remediation of Land aims to provide a state wide planning approach to the remediation of contaminated land, and to reduce the risk of harm to human health and the environment, by consideration of contaminated land as part of the planning process. Under the SEPP, a consent authority must not consent to the carrying out of development on land unless it has considered potential contamination issues.

There are no known areas of contaminated land within the site including no known contaminated areas associated with the existing operations. Therefore, SEPP 55 does not place any constraints on the Modification.

4.3.6 Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995)

Sydney Regional Environmental Planning Policy No. 9 - Extractive industries (SREP 9) aims to:

- facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area by identifying land which contains extractive material of regional significance, and
- permit, with the consent of the council, development for the purpose of extractive industries on land described in Schedule 1 or 2, and
- ensure consideration is given to the impact of encroaching development on the ability of extractive industries to realise their full potential, and
- promote the carrying out of development for the purpose of extractive industries in an environmentally acceptable manner, and
- prohibit development for the purpose of extractive industry on the land described in Schedule 3 in the Macdonald, Colo, Hawkesbury and Nepean Rivers, being land which is environmentally sensitive.

Haerses Road Quarry is located within the land identified in Schedule 2 of SREP 9. As such, development for the purposes of extractive industries is to be permitted with council consent taking into account relevant environmental issues. However, as identified in **Section 4.2.1** the Minister for Planning is the consent authority for the Modification.

5.0 Stakeholder Consultation

Consultation for this proposed modification has been undertaken to inform stakeholders about the Modification, to obtain their views and identify any issues of concern to be investigated and addressed.

5.1 Authority Consultation

In regard to the proposed Modification, Dixon Sand and Umwelt met with DP&E in August 2015. At this meeting, Dixon Sand and Umwelt presented an overview of the status of the quarry development, the proposed modifications, planned approval pathway and approach to the environmental assessment.

Following this meeting a Background Scoping Document was prepared which accompanied the modification application. The Background Scoping Document detailed the proposed modifications and the approach to environmental impact assessment. Following DP&E review of the Background Scoping Document, Dixon Sand was advised that the Secretary's Environmental Assessment Requirements would not be issued for the Modification and that the assessment should proceed as detailed in the Background Scoping Document.

A teleconference with the Commonwealth DoE was held on 18 November 2015 to discuss the Modification and in particular the potential impact on Commonwealth listed threatened species and communities. Following this meeting a referral was prepared identifying the Modification as a controlled action. In February 2016 DoE confirmed that the Modification was a controlled action and that the Modification would be assessed in accordance with the Bilateral agreement under section 45 of the EPBC Act, specifically as a state significant development under Part 4 of the EP&A Act.

On 18 April a teleconference was held between OEH, DP&E, Dixon Sand and Umwelt. The purpose of the teleconference was to provide OEH with background to the Modification and the assessment and findings of the ecological investigations that had been undertaken at that time and the proposed approach to offsetting. Specifically, the assessment approach for the threatened plant *Darwinia biflora* was discussed in relation to the recent changes to OEH policy which allow certain species to be assessed on an area basis rather than on number of individuals basis.

Consultation was also undertaken with representatives of the local Aboriginal community as part of the Aboriginal archaeological and cultural heritage assessment process. Details of this consultation are presented in **Section 6.10**.

Dixon Sand sought a meeting with Department of Primary Industry Water (DPI Water) to discuss the groundwater assessment findings, however due to the timeframe for availability of DPI Water staff a meeting was unable to be held in a suitable timeframe to assist in the preparation of this report.

5.2 Community Consultation

Dixon Sand is committed to being a part of the Maroota community and has continued to consult with the local community regarding the Haerses Road and Old Northern Road quarries since 1991. Dixon Sand facilitate a bi-annual Community Consultation Committee for the Old Northern Road and Haerses Road quarries. The committee discusses environmental and community issues in relation to the quarries and the local area and include representatives from the local community, Maroota Public School, The Hills Council, DP&E, a bush regeneration group, the consultants that undertake the environmental monitoring and Dixon Sand management.

The key mechanism used for community involvement in relation to the proposed Modification was the distribution of a community consultation flyer to the Maroota community and surrounds. The community consultation flyer, attached as **Appendix 2**, provided details of the proposed modifications, the reasons for them and the environmental assessment process to be undertaken. The flyer also contained contact details so that members of the community could raise issues or request further information about the Modification.

Approximately 130 copies of the flyer were distributed in the immediate local area in April 2016. Copies were left in the letterbox of residences along Days Road, Wisemans Ferry Road, Haerses Road, Hitchcock Road and Old Northern Road. A copy of the flyer was sent to Maroota Public School.

At the time of preparing this report one response to the information flyer had been received. The respondent identified the following issues:

- Current and projected traffic numbers and routes
- Use of compression braking
- Potential impacts from dust generation and proposed mitigation measures
- Request for electronic copies of assessment documents.

A Dixon Sand representative has spoken with the respondent to organise a time to meet to discuss the Modification and the identified issues of concern. Dixon Sand have made several follow up attempts to organise a suitable time to meet, however, at the time of preparing this report the meeting has not yet taken place.

6.0 Environmental Assessment

6.1 Identification of Key Environmental and Community Issues

The key environment and community issues that need to be assessed in this EA have been identified through consideration of:

- the existing approved operations and description of the Modification (refer to **Sections 2.0** and **3.0**)
- the findings of the original 2006 EIS (ERM, 2006) and the background scoping document (Umwelt, 2015) prepared for this Modification
- the planning and environmental context for the locality (refer to **Sections 1.3**, **4.0** and **6.0**)
- the environmental risk analysis of potential environmental impacts associated with the Modification (refer to **Section 6.1.1**)
- feedback from the community and government agencies on the issues that they felt are relevant to the Modification and Haerses Road Quarry more generally (refer to **Section 5.2** and **Section 6.11**)
- the findings of baseline studies completed as part of preparation of the EA and the issues that were identified as requiring further assessment.

The issues identified as being relevant to the Modification are assessed in detail in the following sections.

6.1.1 Preliminary Environmental Risk Analysis

A preliminary environmental risk analysis was undertaken for the Modification to identify, from a technical perspective, the key environmental and community issues that are relevant to the Modification and the level of assessment of these issues that is required as part of the EA process.

The method used for the environmental risk analysis encompassed the following key steps:

- identify each element of the Modification
- identify the environmental and community aspects and potential impacts/risks associated with each element of the Modification in the context of the existing approved operations (that is, whether or not there is a change to the impacts approved as part of the existing approvals for the quarry)
- assess the potential scope of the impact/risk to determine the key issues requiring further assessment and the level of assessment required.

The outcomes of the preliminary environmental risk analysis are detailed in **Table 6.1**.

Table 6.1 Potential Environmental and Community Impacts Associated with the Modification

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required?
Land use	The Modification would result in an area of existing bushland within the site being cleared for the proposed extraction area. This change from bushland to active quarry is in keeping with the approved land use of the site.	Yes, refer to **Section 6.2** for further detail.
Soils and agriculture	The Modification would result in an increase to the extraction area of approximately 19 ha with associated disturbance to topsoils. Soil erosion issues are addressed as part of the surface water assessment. Within the local area agricultural pursuits are generally restricted to the flat ridgetop land with side slopes and gullies generally consisting of areas of native vegetation. The existing horticultural pursuits undertaken on parts of the Haerses Road Quarry site all occur on the flat ridge top land that runs north-south through the site. The proposed extraction area is located on the side slope and is approximately 19 hectares in area and is not particularly suited for agricultural pursuits. The use of this land for extractive industry purposes is an appropriate and beneficial use of this land. It is considered that the potential impact on agriculture from the Modification is negligible.	No
Public Infrastructure	The modification would not result in any changes to public infrastructure. Haerses Road will be progressively reinstated after quarrying the resource beneath it in accordance with the existing approval. The modification does not require any change to public infrastructure.	No
Traffic	There will be no changes to the maximum production limit of the quarry, or the methods or volumes of transportation of quarry products from the site. The Modification seeks approval for a change in the distribution of traffic leaving the site, with the opportunity to transport a greater proportion of product direct to market from Haerses Road Quarry. This will divert truck movements away from the Maroota locality and reduce truck movements past the Maroota Public School.	Yes, refer to **Section 6.8** for further detail.

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required?
Groundwater	The location and maximum depth of the quarry pit have been determined through groundwater investigations so that there will be no impact to the Maroota Tertiary Sands Groundwater Source or the Greater Sydney Basin Groundwater Source.	Yes, refer to **Section 6.3** for further detail.
Surface Water	Effective management of water as part of the quarry operations is a key consideration for Haerses Road Quarry. An assessment of the water requirements and potential surface water impacts of the Modification is required.	Yes, refer to **Section 6.4** for further detail.
Noise	Operation of the Modification has the potential to result in changes to noise emissions and a detailed noise assessment is required.	Yes, refer to **Section 6.5** for further detail.
Air quality	Operation of the Modification has the potential to change the impacts of the Haerses Road Quarry on local air quality and a detailed assessment is required to confirm any potential impacts.	Yes, refer to **Section 6.6** for further detail.
Ecology	The Modification disturbance area consists predominantly of native vegetation and therefore an assessment of the ecological impacts of the Modification is required.	Yes, refer to **Section 6.7** for further detail.
Visual	The Modification will result in an additional extraction area with quarrying activities, overburden emplacement areas and noise bunds which has the potential to change the current visibility of the quarry. A visual impact assessment is therefore required for the Modification.	Yes, refer to **Section 6.9** for further detail.
Aboriginal Heritage	Due to the extent of known Aboriginal sites and cultural heritage values in proximity to the Maroota area, a detailed assessment of potential impacts from the Modification is required.	Yes, refer to **Section 6.10** for further detail.
Historic Heritage	The Modification will result in an additional disturbance footprint of approximately 22.5 hectares, however there will be no impact on listed heritage sites as none were recorded within the Modification area or immediate vicinity. Further detail on the heritage searches is provided in **Section 6.11**.	No. Further information is provided in **Section 6.11**.
Socio-economic	The socio-economic impacts of the quarry will remain substantially unchanged, however, as the amenity aspects of the quarry have potential to change, the socio-economic impacts have been reassessed.	Yes, refer to **Section 6.12** for further detail.

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required?
Greenhouse Gas and energy	The Modifications has potential to change the energy use and greenhouse gas emissions of the Quarry. Further discussion regarding this issue is provided in **Section 6.8**.	Yes, refer to **Section 6.13** for further detail.
Hazards	As discussed in **Section 4.3.3**, the approved quarry was determined as part of the original environmental assessment and approval process to not be a hazardous or offensive development. The nature and components of the quarry are not proposed to change as a result of the Modification. Furthermore there would be no change to the inventory or storage of hazardous materials. Diesel fuel and motor oil lubricants may be stored in the maintenance workshop. These chemicals are not classed as hazardous and would be stored in accordance with the relevant Australian Standard.	No
Contaminated land	The original 2006 EIS identified that due to the past land uses on the site it is unlikely to be affected by significant contamination issues. Several items that may have resulted in localised contamination (car bodies, petrol drums and white goods) were removed from Stage 1 of the approved extraction area prior to the commencement of quarrying operations. The Modification extraction area consists entirely of bushland that has been inspected as part of the current investigations. There are no visible signs of any contamination within the Modification extraction area or the processing area. A July 2016 search of the OEH contaminated land database identified that there are no registered contaminated sites in the Maroota area.	No
Rehabilitation and Final Landform	The overall approach to rehabilitation of Haerses Road Quarry will remain unchanged, however, due to the additional quarrying location, overburden emplacement and the refilling of the proposed extraction area there will be some change to the final landform of the site. An updated rehabilitation and closure strategy is therefore required for the Modification.	Yes, refer to **Section 6.14** for further detail.

A detailed assessment of each of the environmental and community aspects identified in the environmental risk analysis as requiring further assessment for the Modification is provided in **Sections 6.2** to **6.14**.

6.2 Land Use

6.2.1 Existing Land Use

The existing land uses of the Haerses Road Quarry site are quarrying, horticulture, some former residential dwellings (owned by Dixon Sand and one of which is used as the site office) and bushland. As part of the approved quarry operations the areas that are occupied by non-quarrying land uses will be progressively converted to quarrying operations as the quarry progresses.

The predominant land uses within the immediate vicinity of the site are rural residential properties along Wisemans Ferry Road and bushland associated with the Deerubbin Local Aboriginal Land Council (LALC) property to the south and west of the site. The land uses in the local area include fruit orchards, market gardens, quarries, grazing of livestock and rural residential properties. The surrounding region is a significant area for quarrying, with at least five sand/sandstone quarries located within the local area.

6.2.2 Impacts to Land Use

The Modification would result in an area of land approximately 19 hectares in size being converted from native vegetation to a quarry extraction area over the life of the quarry. This represents a relatively small area of native vegetation in a local and regional context, with large tracts of native vegetation surrounding the Haerses Road site.

The Modification is not predicted to result in any adverse impacts on the surrounding land uses. The direct impacts of the Modification will be limited to the Haerses Road site and assessment of amenity issues such as noise, air quality and visual have identified that the quarry operations will not result in significant impacts on surrounding land uses.

Haerses Road Quarry is a substantial distance from any major residential areas. The closest being Windsor located approximately 21 kilometres to the south west, Rouse Hill located approximately 24 kilometres to the south south-west and Hornsby located approximately 27 kilometres to the south east. There would be no impact to major residential areas as a result of the Modification.

6.3 Groundwater

The potential for the proposed quarry operations to interact with local groundwater resources was a key consideration for the design of the Modification, with some important groundwater resources existing in the Maroota area. To avoid impacts on groundwater, the proposed extraction area has been designed to remain two metres above the wet weather groundwater level. A detailed assessment of the local groundwater environment has been undertaken to inform the design of the quarry and to avoid groundwater impacts.

The detailed Groundwater Assessment for the Modification was completed by Australian Groundwater Technologies (AGT) and is included in **Appendix 3**. A summary of the key findings of the assessment is included in the following sections.

6.3.1 Existing Groundwater Environment

There are two aquifers in the Maroota area that required consideration as part of the Groundwater Assessment, being:

- the Maroota Tertiary Sands Groundwater Source (MTSGS). The MTSGS occurs in the Maroota Sands deposit and in the upper part of the Hawkesbury Sandstone (eluvial sands)

- the Hawkesbury Sandstone, a regional fractured rock aquifer. The Hawkesbury Sandstone forms part of the Sydney Central Basin Groundwater Source (SCBGS).

Both of these aquifers occur at the Haerses Road Quarry site. The MTSGS occurs along the central portion of the site, to the east of and upslope of the proposed extraction area for the Modification (refer to **Figure 6.1**). The SCBGS occurs within the Hawkesbury Sandstone deposit that is the target of the proposed extraction area for the Modification. However, the aquifer is below the proposed extraction area which will remain a minimum of two metres above the SCBGS wet weather groundwater level.

The MTSGS is recharged by direct rainfall infiltration and is subject to seasonal rainfall variations and longer term climatic cycles. At the Haerses Road site, water bore drilling has identified the MTSGS comprises of thin layers of gravel, thick sequences of clay, and interbedded clays and sands. These profiles are typical of palaeochannel sequences and represent the meandering nature of old river systems (Woodward and Clyde, 1999).

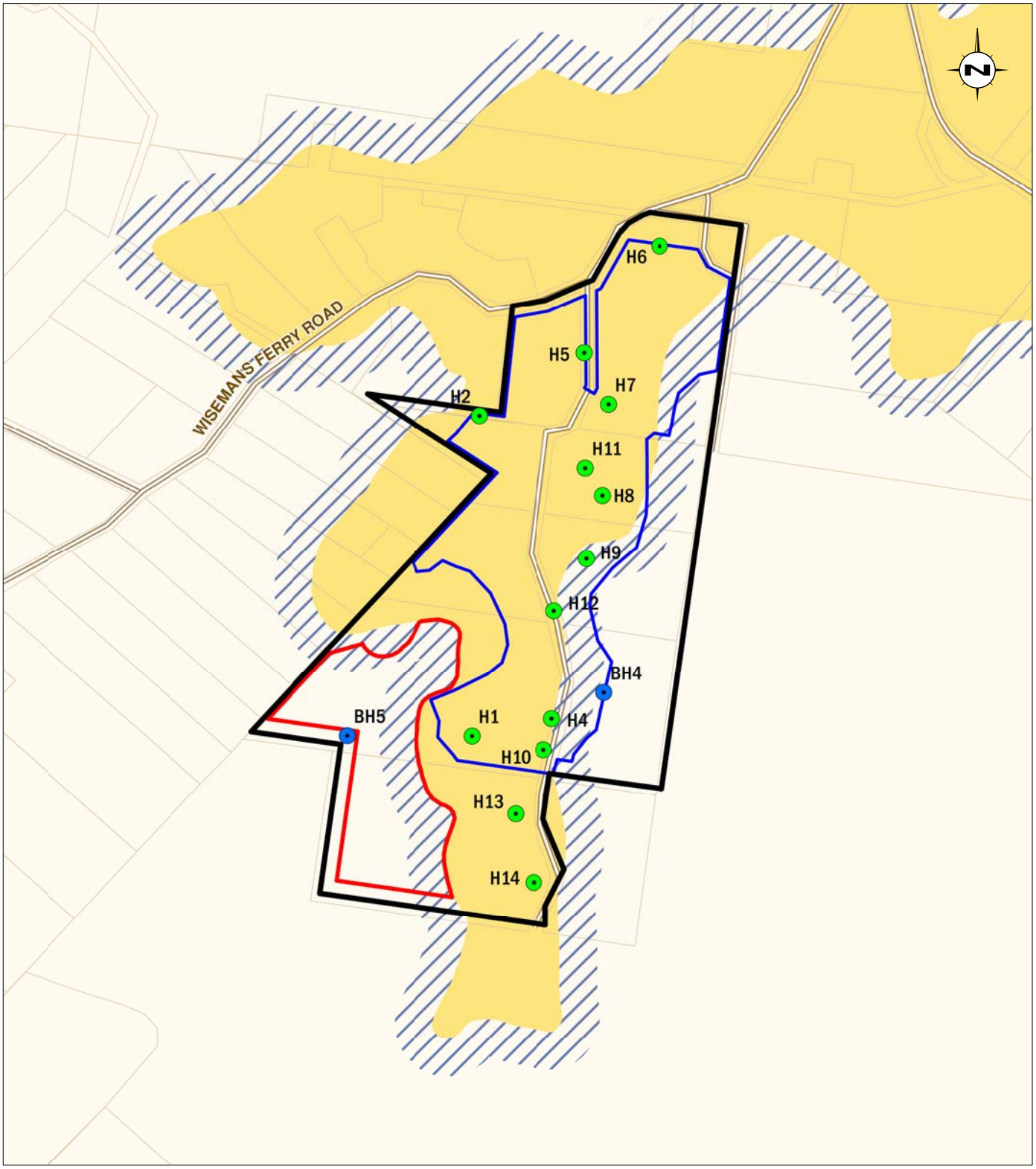
In the weathered profile of the Hawkesbury Sandstone small aquifer zones have developed in the eluvial sand (such as the deposit which is the quarry resource for the approved Haerses Road Quarry), which comprises the leached and weathered profile of the Hawkesbury Sandstone. These zones often form perched aquifer systems above the deeper regional water level of the Hawkesbury Sandstone. In the majority of cases, these perched aquifer systems have limited resource value because, like the Maroota Sand, they have small aerial extent and storage. They act as temporary storage of groundwater prior to leakage to underlying aquifers.

The Hawkesbury Sandstone is generally an impermeable rock and although the rock has very little primary permeability, fracturing and jointing, where open and interconnected, provides secondary permeability and storativity.

Groundwater Levels

The water level of the MTSGS has been monitored and recorded at the Haerses Road Quarry since 2005 while the regional water table of the SCBGS has been monitored and recorded since 2011 (refer **Figure 6.1**).

Within the proposed extraction area the SCBGS wet weather level varies from 146 mAHD in the east to 115 mAHD in the west, therefore the maximum quarry floor level has been set at 148 mAHD in the east and 117 mAHD in the west which is 2 metres above the wet weather level. A summary of the monitoring bores which includes their maximum and average water levels is presented in **Appendix 3**.



Legend

- SCBGS Monitoring Bores
- MTSGS Monitoring Bores
- Site Boundary
- Current Extraction Area
- Proposed Extraction Area
- Maroota Tertiary Sands
- 100 m buffer around Maroota Tertiary Sands
- Cadastral boundary
- Roads

FIGURE 6.1

Location of the Maroota Tertiary Sands

Image Source: Australian Groundwater Technologies (2016)

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Groundwater Quality

In accordance with the current development consent conditions for Haerses Road Quarry, groundwater samples have been collected from each bore for analysis of the following parameters:

- Electrical Conductivity (EC)
- pH
- Totals Suspended Solids (TSS)
- turbidity.

A summary of the natural variation of groundwater quality is provided in **Appendix 3** and summarised below:

- groundwater salinity of the shallow and deep aquifers is very low, ranging from 51 to 435 µS/cm
- pH ranges from 4.1 to 6.6, with deeper bores revealing higher average pH values (5.5) in comparison to the shallower bores (4.6)
- groundwater turbidity and TSS was generally higher in the shallow bores than in the deeper bores.

As the groundwater salinity is less than 1,500 mg/L, the source is classified as a highly productive groundwater source under the criteria of the NSW Aquifer Interference Policy (AIP).

Groundwater Users

There are a total of 40 existing bores within 2.5 km of the site, 28 of which target the deep SCBGS with the remaining 12 targeting the shallow MTSGS. A summary of existing bores in the area is provided in **Appendix 3**.

At the closest point there is one bore that targets the SCBGS (GW109927 – status unknown) located approximately 500 metres west of the proposed extraction area. It was drilled to a depth of 162 m and has a groundwater level of 74 mBGL. The nearest MTSGS bore (GW108385) is located approximately 150 metres southeast of the proposed extraction area and is drilled to a depth of 13 metres.

Coastal Upland Swamp Community

There are two occurrences of a coastal upland swamp community in or in the vicinity of the Modification disturbance area. A small area of coastal upland swamp community is within the proposed extraction area, while a much larger area of coastal upland swamp community was identified to the north of the proposed extraction area and to the west of the current approved extraction area (refer **Figure 6.17**). A drainage line runs east to west through this area of swamp. The drainage line is an ephemeral stream that only exists for a short period of time after rainfall events and is fed by an upstream dam.

The geomorphic development of the coastal upland swamps is driven by positive feedbacks that operate when there is significant excess of precipitation over evaporation. This, along with high run-on from catchments and low rates of percolation and run-off, promotes soil water logging. Drainage of the swamps is mainly via lateral seepage through the sediments with some possible very slow vertical percolation into the underlying poorly permeable bedrock. The coastal upland swamp community is not a groundwater dependant ecosystem.

A 50 metre buffer zone has been designed into the quarry around the swamp where extraction will be excluded. The purpose of the buffer zone is to protect and manage this community providing a barrier to direct disturbance.

6.3.2 Groundwater Impact Assessment

As discussed above, the Modification has been designed to avoid impacts on groundwater by not impacting on the MTSGS (and incorporating a buffer from the edge of the aquifer to provide certainty) and by staying a minimum of two metres above the wet weather groundwater level of the SCBGS. To achieve this outcome, the Groundwater Assessment defined the extent of the aquifers within the local area through updating the conceptual groundwater model for the site, utilising additional drilling data and groundwater level monitoring data obtained since the development consent was granted. The assessment also included a review of groundwater levels to determine the extraction depth limit for the new extraction area which overlays the SCBGS.

Groundwater monitoring data has been used to establish groundwater elevations for the MTSGS since 2005 and the SCBGS since 2011. The highest recorded water level measured in each bore was used to develop a maximum potential extraction depth map. The maximum extraction depth contours represent an elevation of two metres above the wet weather groundwater level sources. As discussed above, the proposed extraction area occurs within the Hawkesbury Sandstone above the level occupied by the MTSGS. The maintenance of the minimum two metre buffer above the wet weather groundwater level will avoid impacts on the MTSGS.

The wet weather elevation of the SCBGS (and extraction depth) is lower than the wet weather elevation of the MTSGS, which as discussed in **Section 6.3.1** and indicated on **Figure 6.2**, is perched approximately 40 metres above the regional aquifer of the SCBGS. Groundwater seepages from the MTSGS will be prevented by the creation of a 100 metre buffer from the western boundary of the MTSGS. No extraction would be undertaken within the 100 metre buffer of the MTSGS until two additional monitoring bores within the western margin of the MTSGS have been established and monitoring shows that quarrying can be undertaken in this area without impacting on the MTSGS. The decision to commence quarrying in this area will be undertaken in consultation with DPI Water and with the approval of DPE.

The Groundwater Assessment found that:

- the proposed extraction area remains entirely in the unsaturated zone and will not result in capture of groundwater
- the MTSGS and SCBGS will not be intercepted during quarrying operations
- there will be no interference with neighbouring bores
- no groundwater supply works are being carried out as part of the Modification.

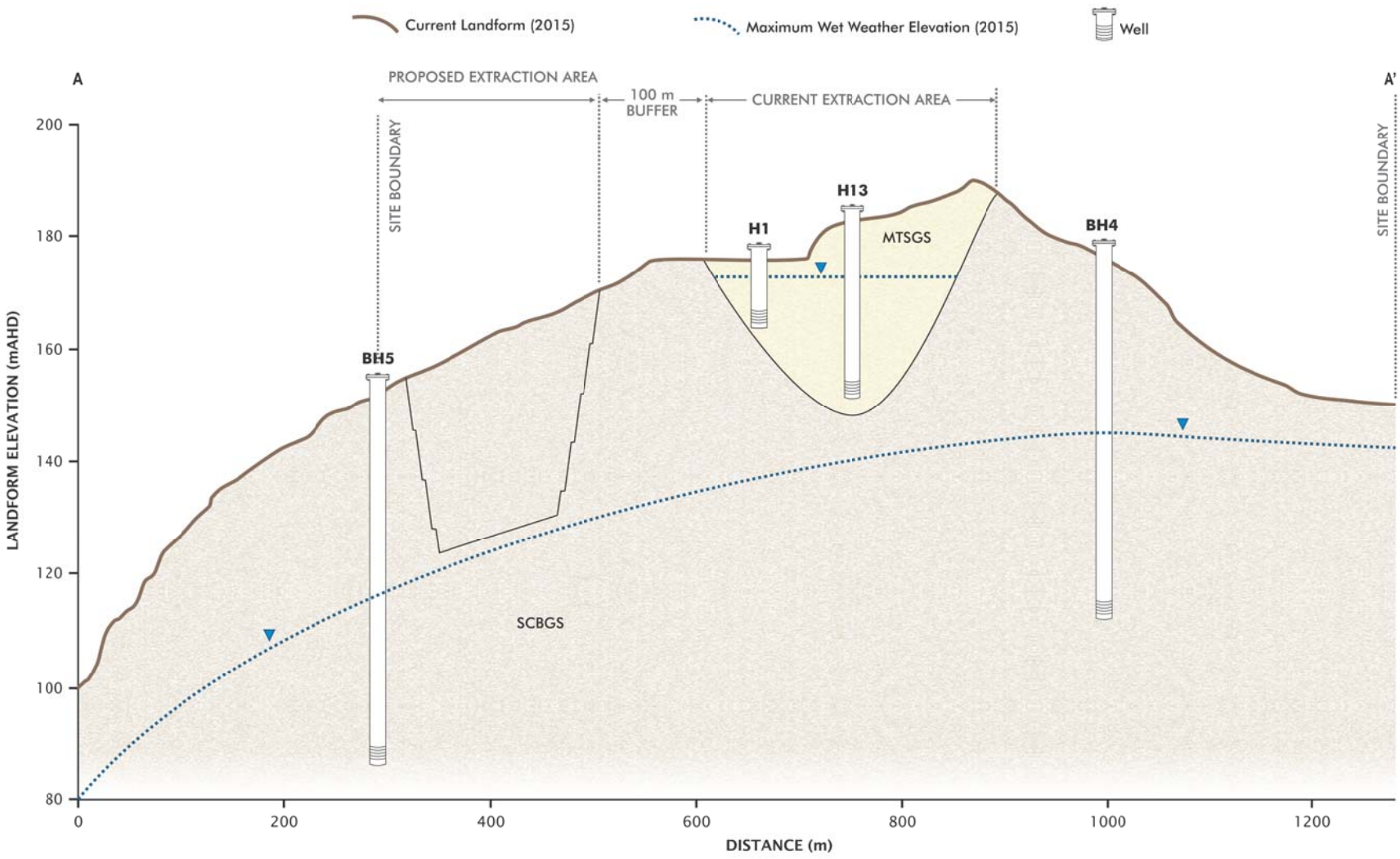

FIGURE 6.2

Wet Weather Elevation of Groundwater Sources

Image Source: Australian Groundwater Technologies (2016)

6.3.3 Assessment against the NSW Aquifer Interference Policy and Water Sharing Plan

Since the development consent for Haerses Road Quarry was granted, policy changes have seen the introduction of the Greater Metropolitan Region Groundwater Sources Water Sharing Plan (WSP) (2011) and Aquifer Interference Policy (AIP) (2012). The Modification requires consideration against both of these policies.

NSW Aquifer Interference Policy

The AIP describes the requirements for a proponent when designing a project, completing an environmental assessment, how the NSW Government will assess and regulate aquifer interference activities and describes minimal impact considerations (or minimal harm criteria) for water pressure, water table and water quality.

As the proposed extraction area has been designed to avoid impacts on groundwater, the groundwater assessment found that the Modification is not predicted to have adverse effects on the water table, water pressure or water quality within or surrounding the site. As such, the Modification is considered to meet the minimal impact considerations under the AIP and therefore the groundwater impacts of the Modification are considered acceptable under the AIP.

Further details of the assessment against the AIP minimal harm criteria are contained in **Appendix 3**.

Greater Metropolitan Region Groundwater Sources Water Sharing Plan

The MTSGS and the SCBGS are the gazetted groundwater resources within the vicinity of the proposed extraction area for the Modification. As discussed above, the MTSGS occurs to the east of the proposed extraction area and a 100 metre buffer has been incorporated into the design of the quarry to avoid impact. No extraction would be undertaken within the 100 metre buffer of the MTSGS until two additional monitoring bores within the western margin of the MTSGS have been established and monitoring shows that quarrying can be undertaken in this area without impacting on the MTSGS. The SCBGS underlies the proposed extraction area with the extraction depth limited to avoid impacts on this aquifer.

The Groundwater Assessment found that the Modification will not involve groundwater extraction or interception of gazetted groundwater sources for any purpose.

6.3.4 Groundwater Licensing

As outlined in **Section 6.3.2**, the groundwater assessment indicates that there will be no interception of groundwater as a result of the Modification. As a result, no groundwater licences will be required for the Modification.

6.3.5 Mitigation, Monitoring and Management Measures

A groundwater monitoring program for the Haerses Road site has been ongoing since 2005. The groundwater monitoring network has included 15 monitoring bore locations, of which six have been decommissioned or replaced (refer to **Figure 6.1**). The existing groundwater monitoring program has been designed to detect changes in groundwater levels, groundwater quality, or to indicate an abnormal condition in response to quarrying. Key aspects of the groundwater monitoring program include:

- water quality sampling from groundwater across the site on a biannual basis

- monitoring and assessment of any groundwater inflows and quality to the existing quarry pit, in the unlikely event that groundwater inflows occur (noting that the existing pit has been designed to stay two metres above the wet weather groundwater level of the MTSGS)

- monitoring groundwater levels in the MTSGS and SCBGS.

Monitoring will be continued for the life of the Haerses Road Quarry operations to continue to refine the mapping of the extent of the MTSGS and the wet weather groundwater level in both the MTSGS and the SCBGS to allow appropriate buffers to be maintained throughout the life of the quarry. The monitoring will also serve to detect any unpredicted groundwater level or quality impacts. No extraction would be undertaken within the 100 metre buffer of the MTSGS until two additional monitoring bores within the western margin of the MTSGS have been established (refer to **Figure 6.1**) and monitoring shows that quarrying can be undertaken in this area without impacting on the MTSGS. The decision to commence quarrying in this area will be undertaken in consultation with DPI Water and with the approval of DPE..

The strategy for groundwater management at the site is to prevent groundwater inflows to the quarry, and preservation of pre-quarrying groundwater quality. For the proposed extraction area, the strategy involves maintaining the depth of mining to an elevation which is at least two metres above the 'wet weather' groundwater elevation for the SCBGS and creation of a 100 m buffer zone from the western edge of the MTSGS within which no extraction would be undertaken until monitoring shows that quarrying can be undertaken in this area without impacting on the MTSGS.

The Groundwater Assessment has identified mitigation measures for each potential impact including unpredicted impacts. The proposed groundwater monitoring program therefore specifically deals with:

- a mechanism for ensuring the operations are compliant with the rules of the WSP and AIP (DPI, 2012)

- unforeseen impacts on groundwater levels on neighbouring properties and on any users of groundwater that target the MTSGS or SCBGS

- unforeseen impacts on groundwater quality

- ongoing monitoring of local and regional groundwater levels and quality during the quarry operations and on a reduced basis for at least five years post quarrying to confirm that the quarry avoids impacts on groundwater.

A Trigger Action Response Plan (TARP) for groundwater will be developed as part of the ongoing groundwater monitoring program to focus upon appropriate trigger and response actions for the management or mitigation of any unpredicted impacts that occur. The monitoring program that is in place will be used to establish the triggers, which will be designed to identify any potential impacts and trigger an appropriate response. Further details on the proposed groundwater TARP are provided in **Appendix 3**.

6.4 Surface Water

There is the potential for the Modification to change impacts on surface water due to the additional quarry footprint, construction of new haul roads and change in water usage. This section provides an assessment of the potential surface water impacts including a site water balance.

6.4.1 Surface Water Context

All current and approved operations at Haerses Road Quarry are located within the catchment area of Little Cattai Creek (refer to **Figure 6.3**) which discharges to the Hawkesbury River approximately 12 kilometres south west of the site. The Little Cattai Creek catchment covers an area of 9,980 hectares with the Haerses Road Quarry site comprising 128 hectares or 1% of this catchment area.

Dixon Sand currently manages surface water at the site in accordance with the *Haerses Road Sand Quarry Site Water Management Plan* (SWMP) (ERM, 2006). The approved quarry water management system (WMS) covers the existing operations encompassing an area of approximately 68 hectares. This area includes existing dams within the site which capture runoff from undeveloped portions of the site. The quarry WMS is proposed to increase by approximately 25 hectares with the addition of the new extraction area and wet and dry processing plant area. This would take the total area covered by the quarry WMS to approximately 93 ha. The existing WMS is described in **Section 6.4.3.1** and the proposed WMS is described in Section **6.4.3.2**.

The Haerses Road Quarry site is underlain by two separate soil landscapes – the Maroota (ma) and Gymean (gy) soil landscapes as per mapping undertaken by McInnes (1997). Both soil landscapes have a high to extreme erosion hazard under concentrated flows and are also highly permeable. Therefore, particular care must be taken with erosion and sediment control measures to prevent erosion of soils and off site sediment transport. This risk has been considered in the design of the WMS for the Modification.

6.4.1.1 Downstream Users

The site is located within the Little Cattai Creek Catchment which ultimately drains to the Hawkesbury River approximately 12 kilometres to the south west of the site. Water use within the catchment is regulated under the *Water Sharing Plan (WSP) for the Greater Metropolitan Region Unregulated River Water Sources* which commenced on 1 July 2011.

The WSP covers an area of approximately 32,500 square kilometres, from Shoalhaven Heads in the south, Broken Bay in the north, Lithgow to the west and Goulburn to the south west. The WSP encompasses 87 management zones that are grouped into six water sources. The site falls within the catchments for the Hawkesbury and Lower Nepean Rivers and specifically within the Upper Hawkesbury River Management Zone (Cattai Creek to Colo River).

Surrounding and downstream land uses include agriculture, extractive industries, forestry and the residential areas of Maroota. Agricultural activities include orchards, market gardens and grazing and are mostly restricted to the Maroota Ridge. The Maroota State Forest adjoins the eastern and southern boundaries of the site. The Broadwater Swamp is approximately eight kilometres downstream of the site, connecting Little Cattai Creek to the Hawkesbury River.

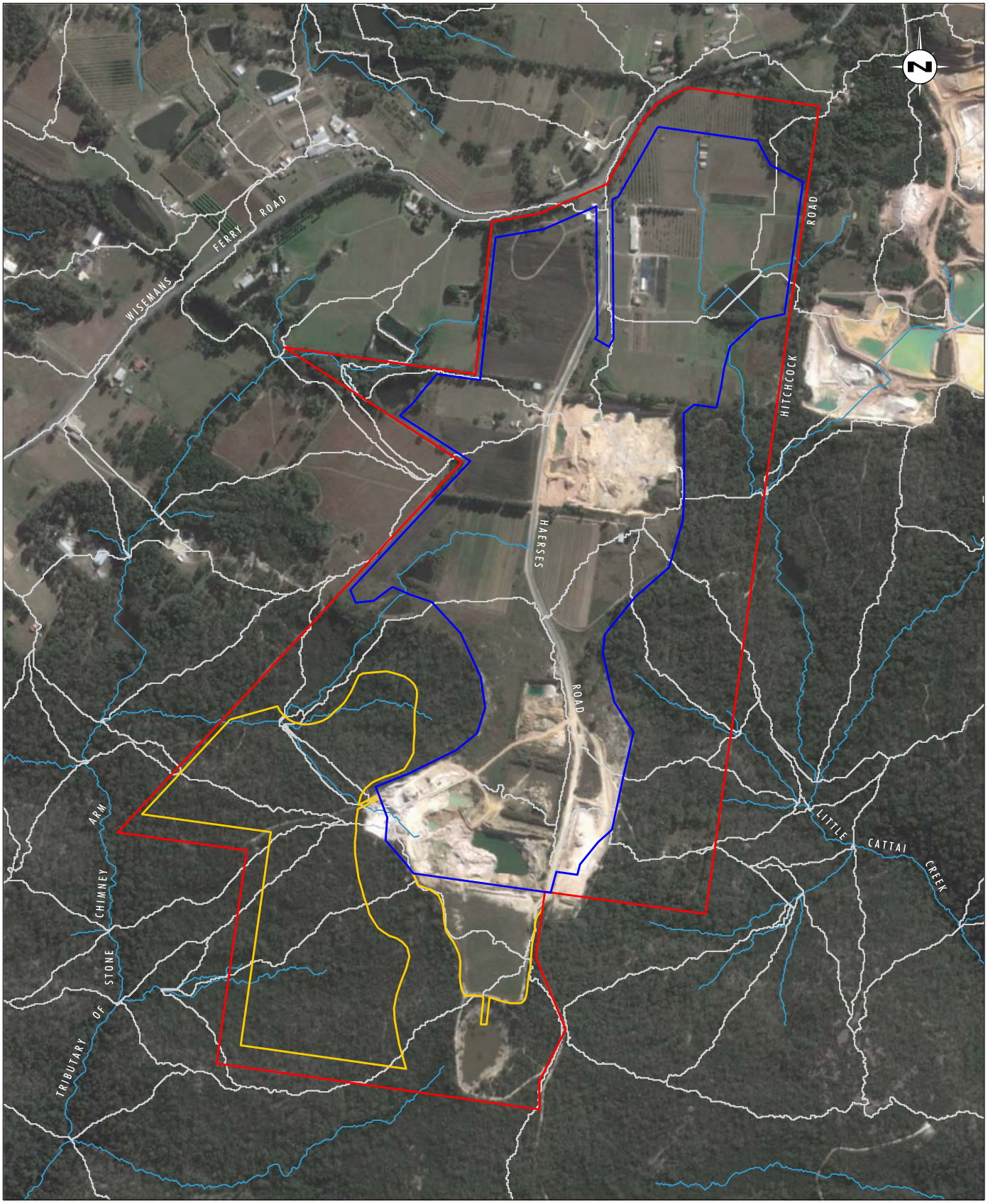

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Catchment Boundary
- Drainage Line

FIGURE 6.3

Haerses Road Querry Catchments and Drainage Lines

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6.4.2 Potential Surface Water Impacts

The Modification has the potential to result in the following impacts on the management of surface water resources:

- changes to surface water flows due to the addition of new WMS controls including clean and dirty water controls (refer **Section 6.4.3.2**) and the capture of water within the quarry WMS
- changes to the amount of water captured by and used at the quarry (that is, the site water balance, refer **Section 6.4.4**)
- changes to impacts on downstream surface water systems (refer to **Section 6.4.5**).

These potential impacts are assessed in the following sections.

6.4.3 Water Management System

6.4.3.1 Existing Water Management System

The principal objectives of the existing water management strategy at Haerses Road Quarry are:

- maintenance of a two (2) metre extraction buffer to the groundwater table (wet weather high level)
- minimisation of the area of soil disturbed and exposed to erosion
- control of water flow through the site (i.e. separating 'clean' and 'dirty' water and directing sediment laden water to sediment basins)
- containment of dirty water on site to prevent off site discharges
- rehabilitation of disturbed areas quickly to limit erosion potential
- maintenance of soil and water management measures throughout the life of the quarry.

The key components of the existing WMS for Stages 1 and 2 that are currently operational at the Haerses Road Quarry are shown on **Figure 6.4**.

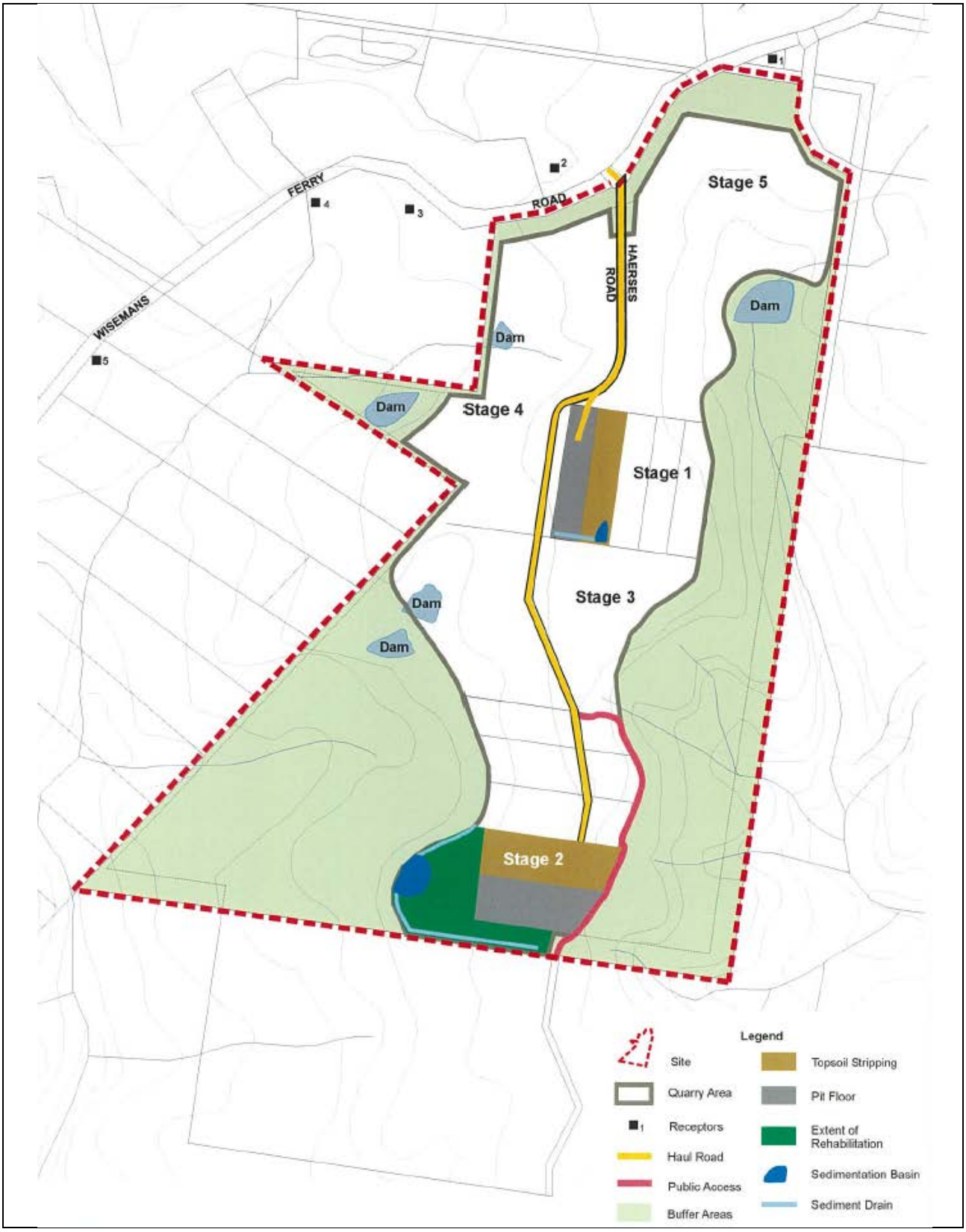

Figure 6.4 Existing Water Management System and Proposed Quarry Plan for Stages 1 & 2

Source: Figure 2.3a Dixon Sand EIS – Haerses Road, Maroota NSW (ERM, 2005)

Historically, Dixon Sand has not needed to manage and release water captured from upslope catchment areas. This is attributable to the highly permeable sandy soils on the site, where water runoff is only generated in significant quantities during very heavy rainfall events. Presently, clean water is diverted around the extraction areas using earth banks constructed in accordance with Landcom's *Managing Urban Stormwater Soils and Construction Volume 1 and Volume 2e – Mines and Quarries* (the Blue Book) (2004). The location of these earth banks is moved as the quarry progresses so that no clean water flows enter the extraction area.

All stormwater within the quarry pit is contained and directed to sediment basins within, or adjacent to, the quarry floor. The quarry floor is generally graded so that all stormwater drains to the nearest sediment basin, where catch drains within the quarry floor collect and control stormwater flows. The high permeability of the quarry floor maintains current infiltration and groundwater recharge rates, and also ensures that the depth and duration of surface water ponding with the quarry is minimal.

The WMS also involves maintaining sediment basins within rehabilitated areas until such time that sufficient vegetative cover is established and the soil surface is stabilised.

6.4.3.2 Proposed Water Management System

The proposed WMS for the Modification will build on the existing WMS for Haerses Road Quarry and will focus on:

- diversion of clean water around the proposed disturbance area for the Modification
- capture, treatment and reuse of dirty (sediment laden) water from within the disturbance area
- avoiding the need for discharge of dirty water from the quarry operations.

The existing WMS will be expanded to cater for the Modification including the addition of three new sediment basins and associated drains. Operation of the existing WMS will remain unchanged as a result of the addition of the new sediment basins and associated drains.

As part of the Modification, the following additions to the WMS are proposed:

- a large in-pit sump to capture and store water from the proposed extraction area as during most stages of extraction the quarry floor will be below ground level and will not be able to drain to existing surface water catchments.
- three additional sediment basins located in the south west, west and north west corners of the extraction area to manage dirty water runoff from each of the cells as extraction progresses
- additional dirty water drains at the boundaries of the extraction cells to assist in directing dirty water to the appropriate sediment basins during all phases of the extraction process
- additional clean water drains to intercept runoff from the upslope catchment and convey runoff around the disturbed areas.

The proposed extensions to the WMS for the Modification, including proposed drains and sediment basins are shown on **Figures 6.5** to **6.10**. The area of the catchments within the extended WMS for the quarry are displayed in **Table 6.2**.

The conceptual locations of the three additional sediment basins are shown on **Figure 6.10**, however detailed design work on the placement and design of these sediment basins will be undertaken as part of the implementation of the Modification. All controls will be designed as per the Blue Book. The stage at which each of the proposed conceptual sediment basins is required to be installed is listed in **Table 6.2**. Sediment basins will be required to be maintained until appropriate levels of rehabilitation are achieved across the contributing catchment.

Runoff from the proposed new wet and dry processing area to the east of the proposed new extraction area will be diverted into an existing sediment basin located to the south through the use of dirty water drains.

The new quarry haul roads will be constructed and managed in accordance with the SWMP. Mitre drains will be constructed at regular intervals (typically no greater than 50 metres) to shed water from the shoulders of haul roads and from table drains to nearby sediment basins. This will also reduce runoff velocity and therefore erosion of haul road drains and shoulders.

Clean water run-on into the proposed new extraction area and new processing plant area will be prevented through the use of clean water drains located upslope of the extraction areas and processing plant area. Conceptual locations for the clean water drains are shown for each stage of extraction on **Figures 6.5** to **6.10**. Clean water drains will be installed along the contour to allow fall of water along the drains to a designated outlet point stabilised with a level spreader (or similar). This will prevent the capture of clean water from upslope catchments and reduce the amount of water to be managed as part of the quarry WMS.

All new WMS infrastructure will be managed in accordance with the controls listed in the SWMP. The SWMP will be updated to incorporate the new infrastructure. No off-site discharge of “dirty water” is proposed from the extraction or processing areas.

Conceptual sizing of all sediment basins related to the proposed extraction area and new processing plant is provided in **Table 6.2**. These sizes are based on conceptual quarry plans and will be reviewed and revised as necessary prior to construction as part of the detailed design of the quarry.

Table 6.2 Conceptual sediment basin sizing for proposed additional extraction and processing areas

Dam Name	Installed in stage	Maximum Catchment Area (ha)	Encompassing extraction stages	Provisional Sediment Basin Volume (ML)
Basin 1	1	9.5	1-3	0.8
Basin 2	4	3.8	4	0.3
Basin 3	5	6.6	4-5	0.6
Basin 4*	1	8.3	Wet and dry processing plant area	0.7

* Note: This basin is existing on-site. Dixon Sand estimate the capacity of this basin is greater than 10 ML which is in excess of the required provisional basin volume.

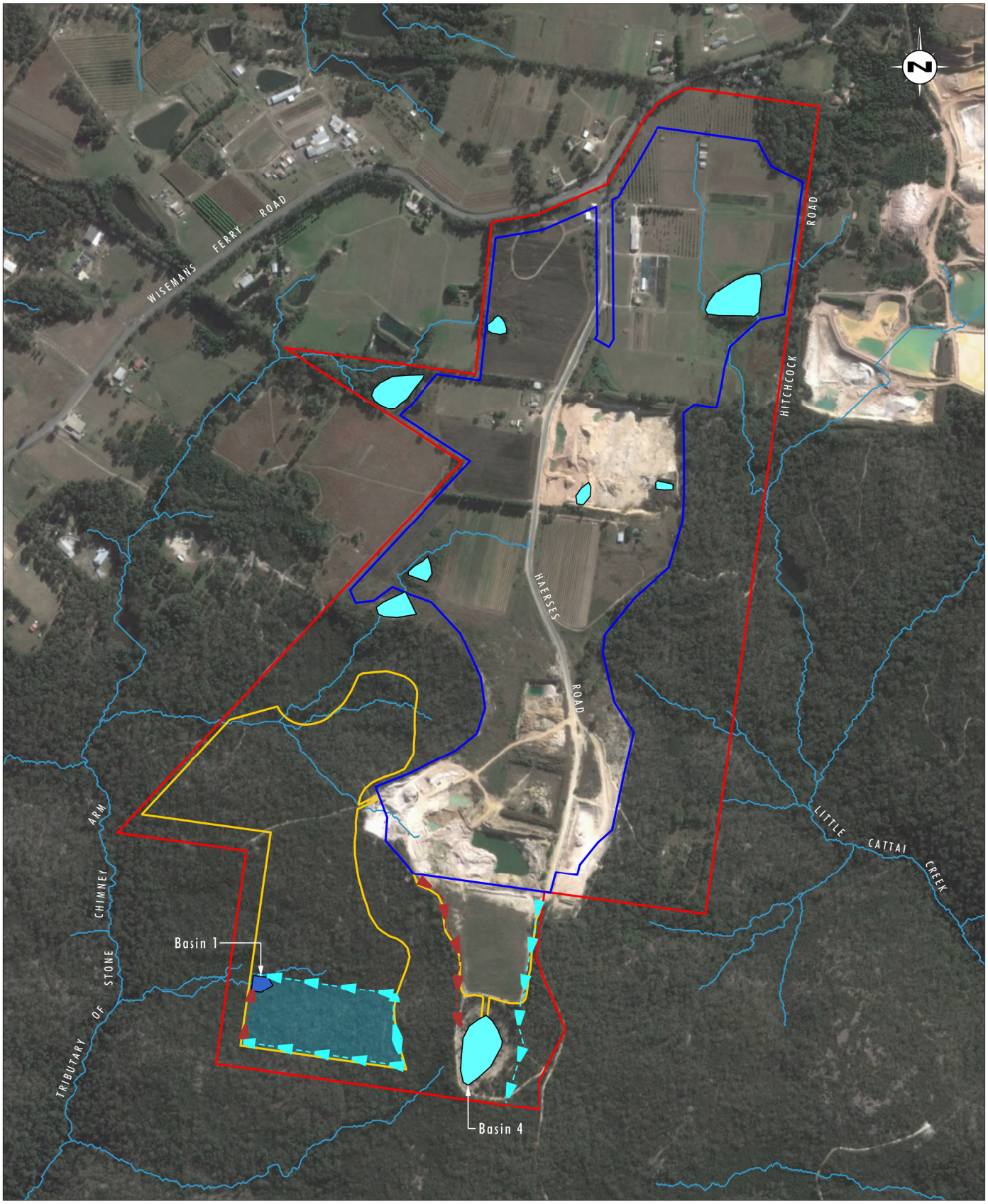

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Cell 1 WMS
- Existing WMS Drainage Pond
- Basin
- Clean Drain
- Dirty Drain
- Drainage Line

FIGURE 6.5

Cell 1 Water Management System

File Name (A4): R05/3479_049.dgn
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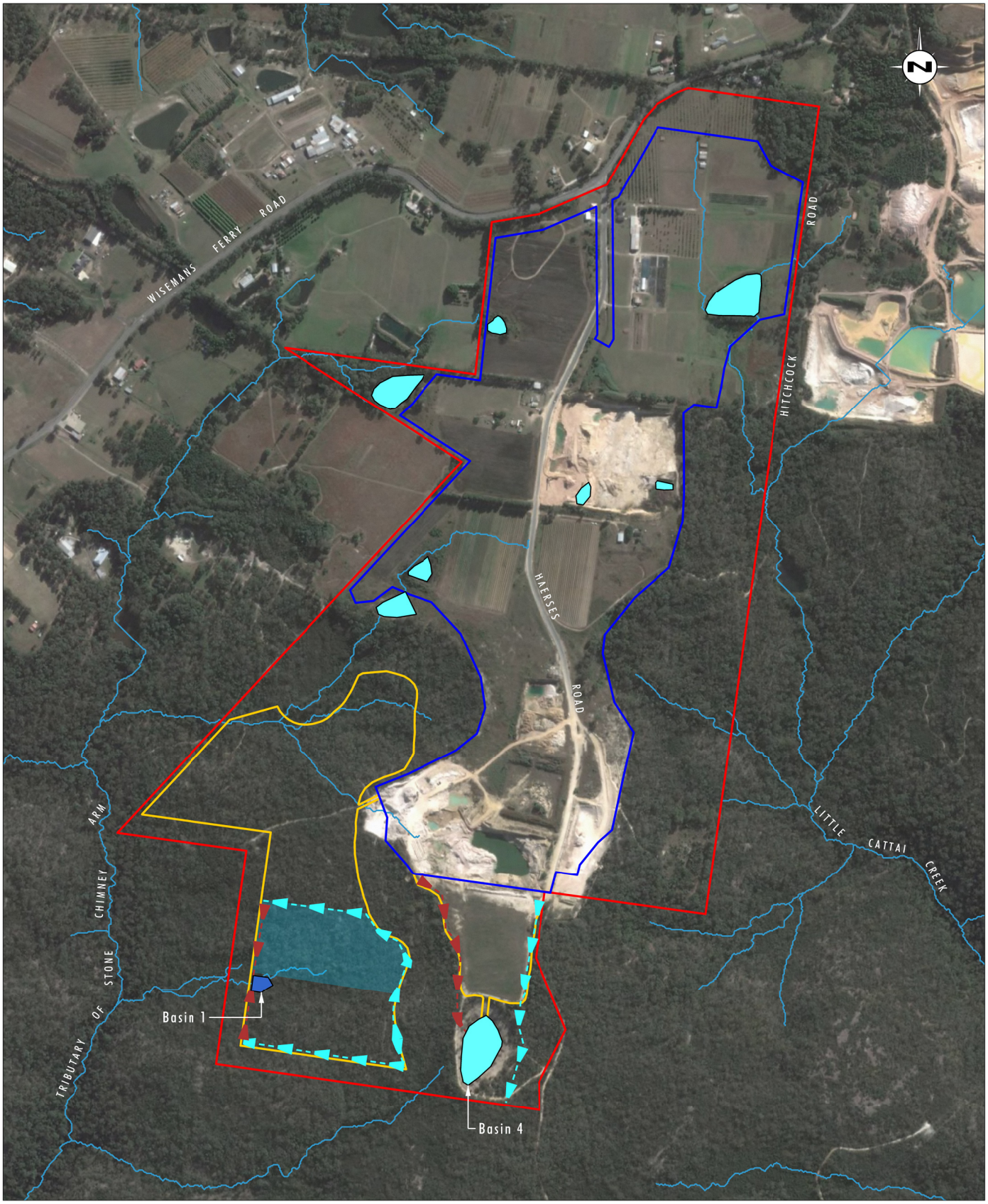

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Cell 2 WMS
- Existing WMS Drainage Pond
- Basin
- Clean Drain
- Dirty Drain
- Drainage Line

FIGURE 6.6

Cell 2 Water Management System

File Name (A4): R05/3479_050.dgn
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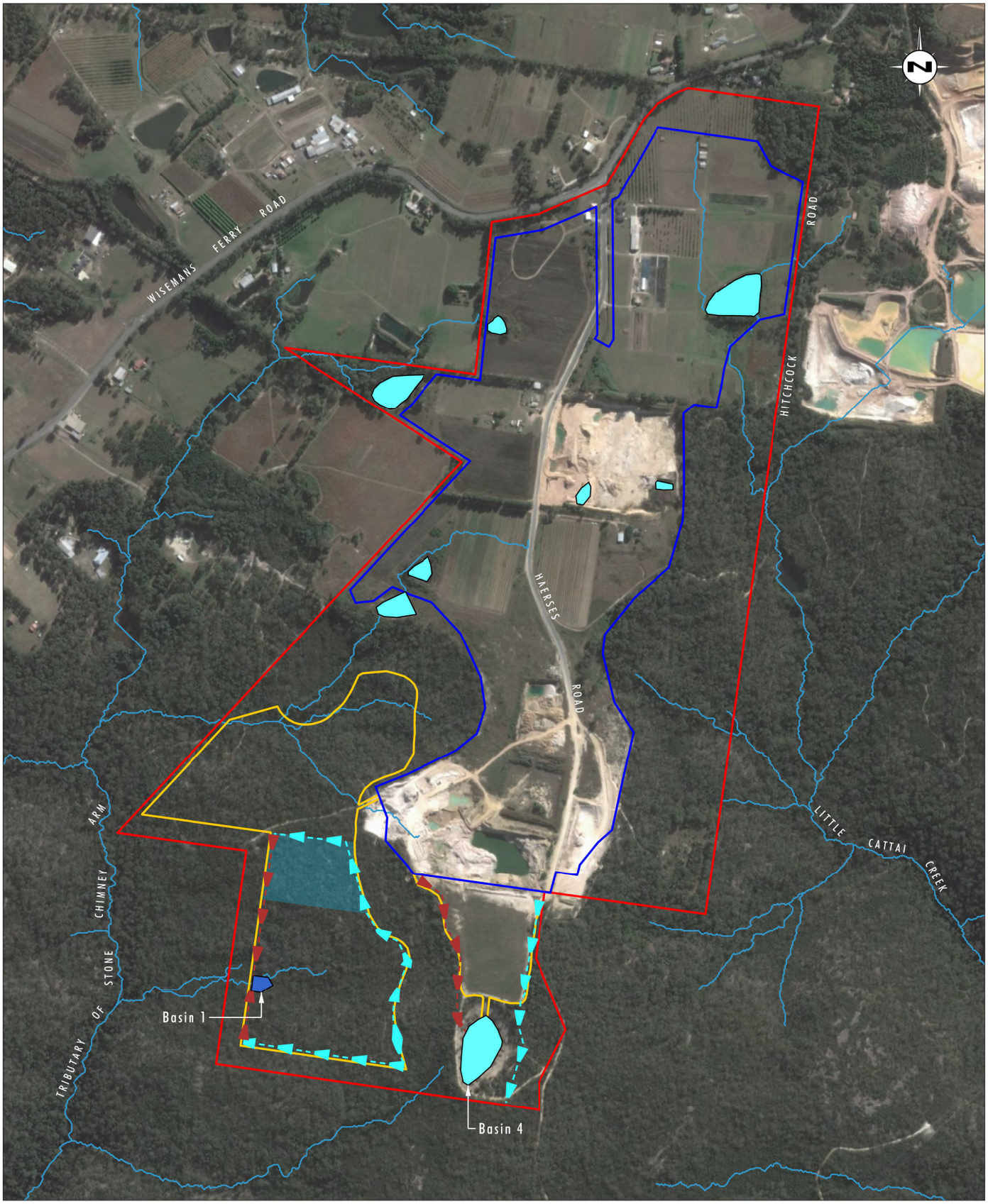

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Cell 3 WMS
- Existing WMS Drainage Pond
- Basin
- Clean Drain
- Dirty Drain
- Drainage Line

FIGURE 6.7

Cell 3 Water Management System

File Name (A4): R05/3479_051.dgn
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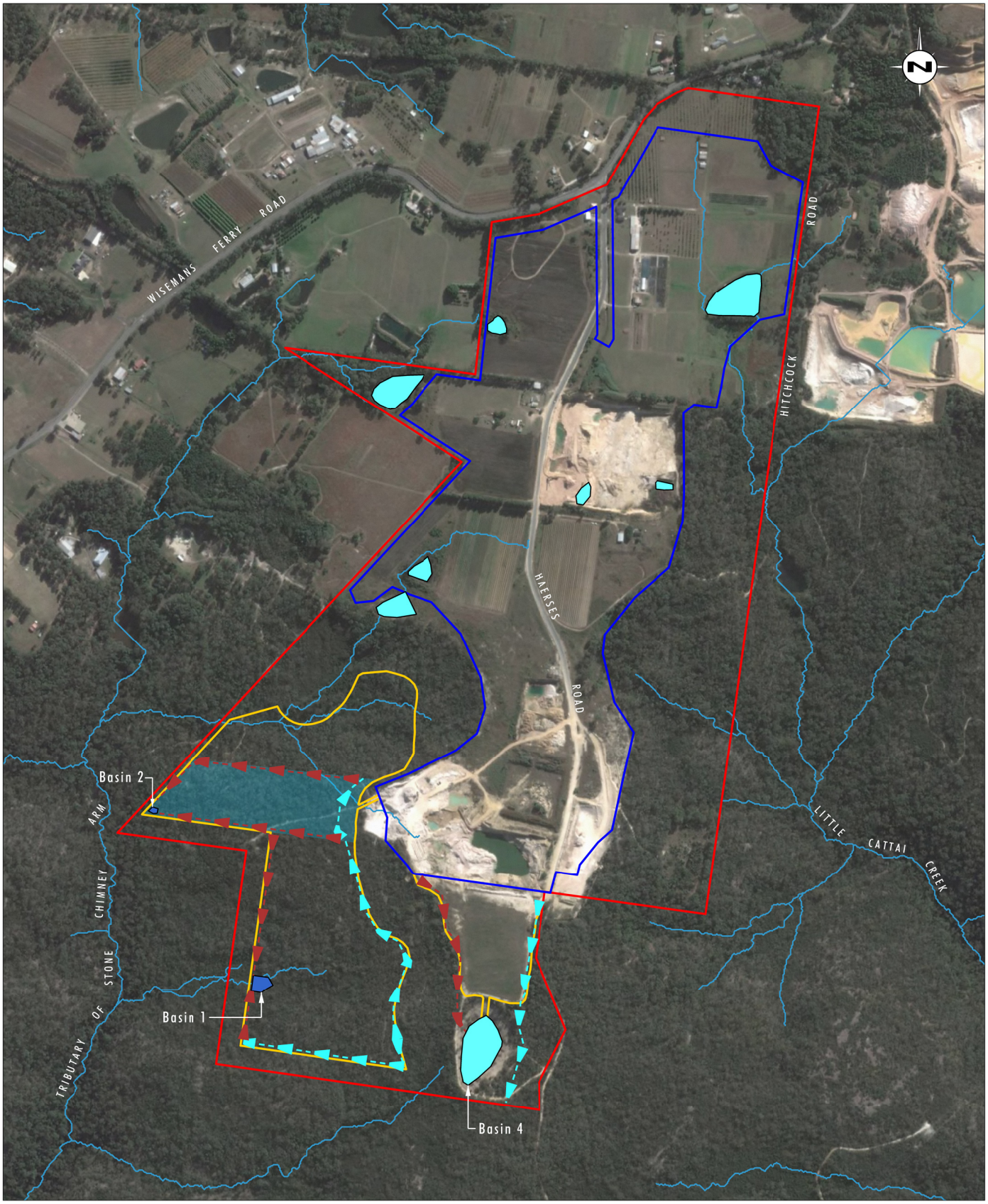

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Cell 4 WMS
- Existing WMS Drainage Pond
- Basin
- Clean Drain
- Dirty Drain
- Drainage Line

FIGURE 6.8

Cell 4 Water Management System

File Name (A4): R05/3479_052.dgn
20160922 10.24

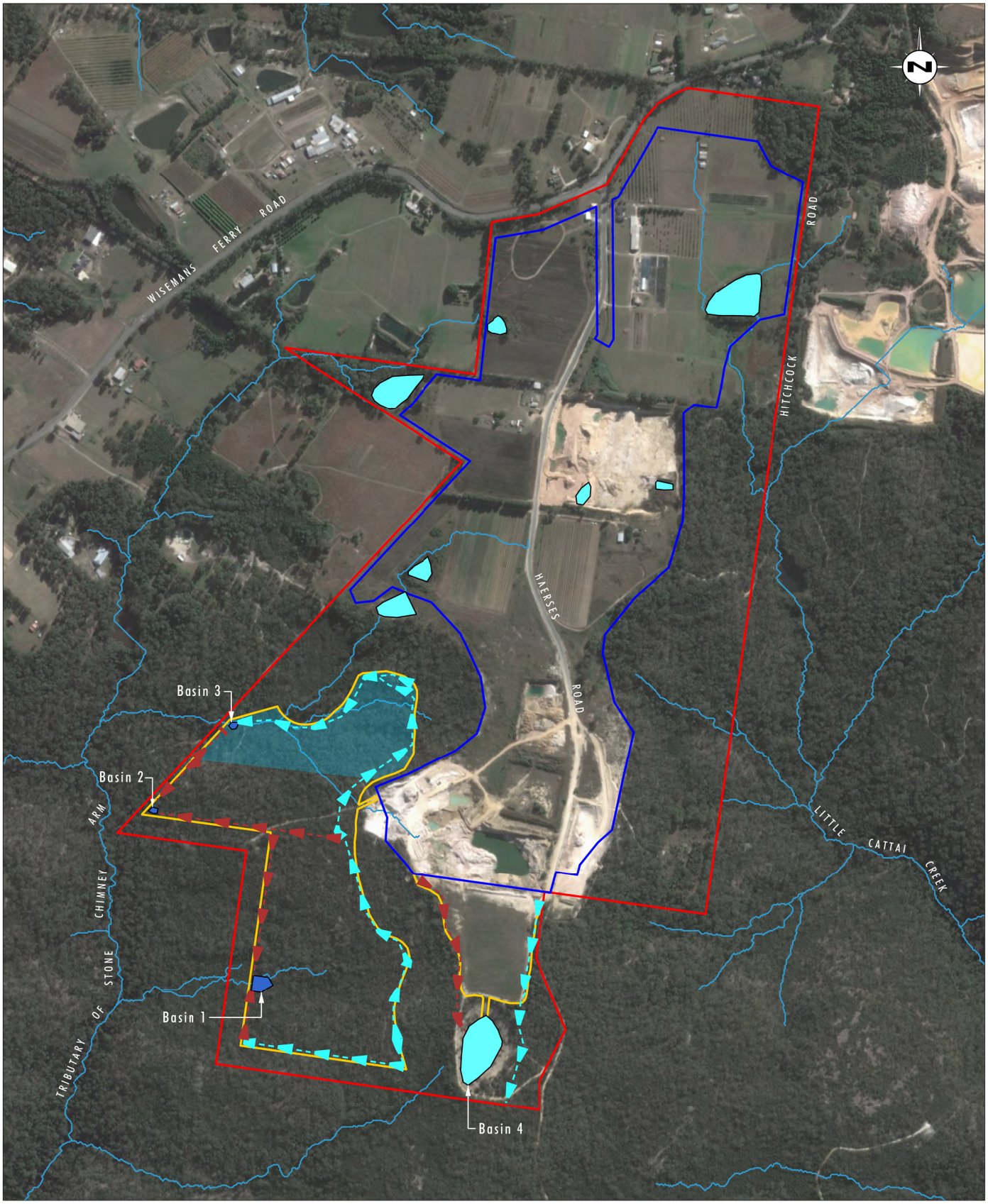

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Cell 5 WMS
- Existing WMS Drainage Pond
- Basin
- Clean Drain
- Dirty Drain
- Drainage Line

FIGURE 6.9

Cell 5 Water Management System

File Name (A4): R05/3479_053.dgn
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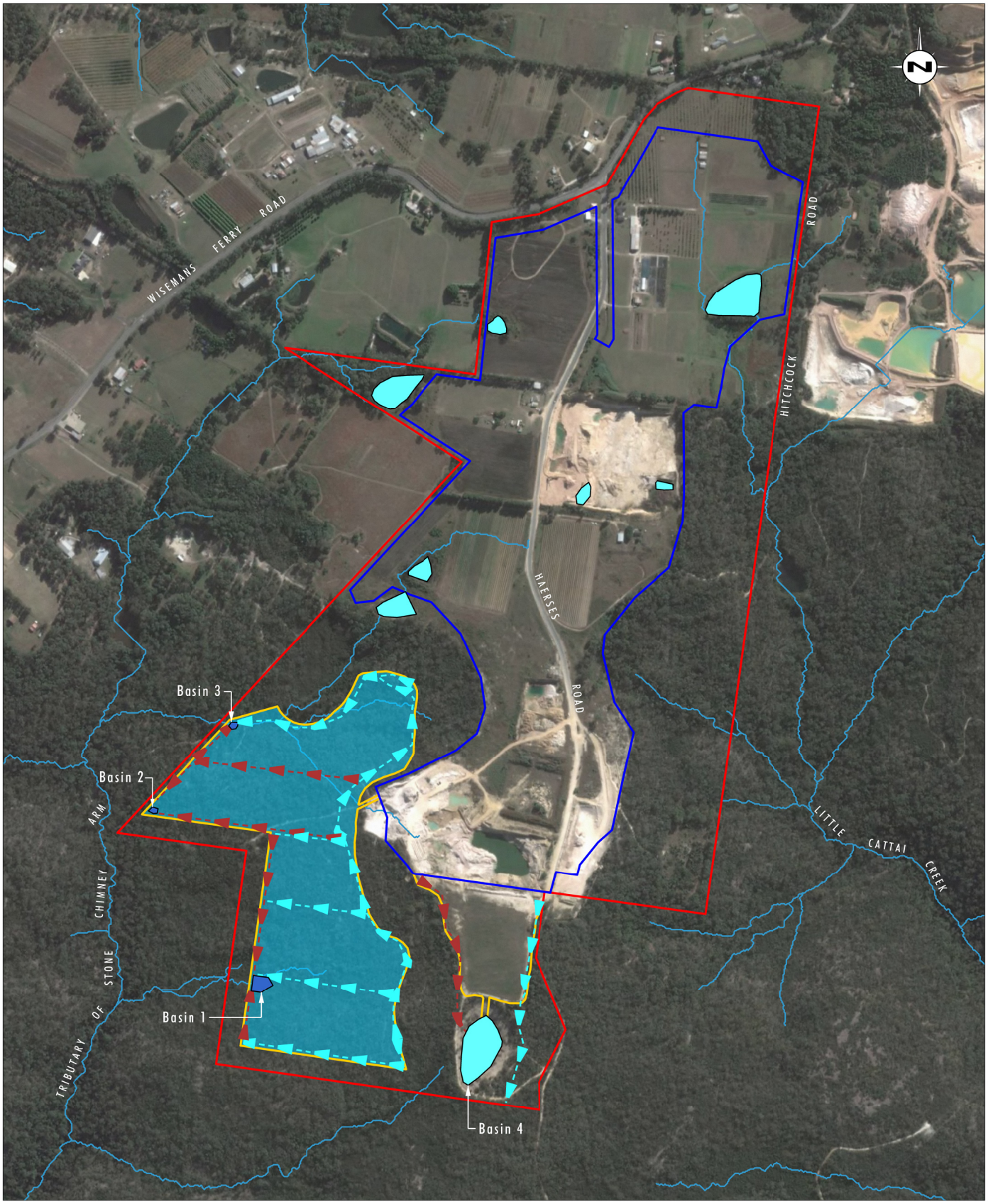

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Final WMS
- Existing WMS Drainage Pond
- Basin
- Clean Drain
- Dirty Drain
- Drainage Line

FIGURE 6.10

Final Water Management System

File Name (A4): R05/3479_054.dgn
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The provisional basin volumes were calculated in accordance with the Blue Book (Volume 2) and the Dixon Sand EPL No. 12513 design requirements. Design parameters are included in **Table 6.3**.

Table 6.3 Sediment Basin Design Parameters[1]

Parameter	Value	Units
$R_{90\%ile,\ 5\text{-}day}$ design rainfall depth[2]	39.7	mm
Soil hydrologic group	A	-
'C_v', volumetric runoff coefficient	0.15	-
Sediment zone sizing factor	50	%
Basin Type	Type F	-

1. Source: Landcom, 2004
2. 5-day, 90th percentile design rainfall depth for Richmond

Dirty water within the proposed new sections of the WMS will continue to be reused on site for dust suppression and processing.

6.4.4 Water Balance

The Modification will result in changes to the water balance for the quarry due to increased surface water capture with the increased footprint and increased water usage due to factors including increased haul road length and water demand for the proposed wet plant and associated crushing infrastructure. The following section provides an updated water balance for the quarry including the Modification.

6.4.4.1 Overview

Inflows to the quarry water balance include site rainfall runoff captured in the WMS.

The current water demands at the quarry are primarily water for dust suppression, while future water demands will primarily be for the wet processing plant. The watercart utilises water from the nearest dam containing water for the purposes of suppressing dust on unsealed haul roads.

The site has access to fresh water for potable uses.

6.4.4.2 Water Sources

For water balance considerations it is important to have data that contains the long term climate records for a site (i.e. typically greater than 100 years). There are numerous BoM stations located in the region surrounding Haerses Road Quarry that record daily rainfall. Long term daily rainfall data is available for Old Telegraph Rd, Maroota (Station 067014) located approximately 2 kilometres north east of Haerses Road Quarry with daily rainfall records from 1925 to date. Although the data available is missing some periods of data (i.e. 1954 to 1965), and has patchy data during some periods (i.e. 1986 to 2013), a comparison of long term climate records indicates that the available good quality data captures the long term rainfall variation (i.e. long term wet and dry periods).

The daily rainfall data for the above BoM station is summarised in **Table 6.4**.

Table 6.4 Yearly Rainfall

Percentile	Yearly Rainfall (mm)
10th percentile	584.2
50th percentile	841.8
90th percentile	1161.3

In the region surrounding Haerses Road Quarry, there is only one Bureau of Meteorology (BoM) station, the University of Western Sydney (UWS) Hawkesbury Campus (Station 067021), which currently records daily evaporation data. The UWS BoM Station is located approximately 26 kilometres south west of Haerses Road Quarry and has daily evaporation records from 1973 to date.

Annual pan evaporation has been recorded at the UWS Hawkesbury Campus (Station 067021) for the years 1973 to 2016. Analysis of the historical record shows an expected trend of evaporation increasing during the summer months and decreasing during the winter months. Average daily evaporation data for each month of the year is shown in **Table 6.5**.

Table 6.5 Average Daily Pan Evaporations

Month	Average Daily Pan Evaporation (mm/day)
January	5.9
February	4.9
March	4.0
April	3.0
May	2.1
June	1.7
July	1.8
August	2.7
September	3.8
October	4.7
November	5.0
December	5.6

6.4.4.3 Water Demands

Current water use at Haerses Road Quarry is estimated at approximately 14 ML per year (primarily for dust suppression) and is predicted to be approximately 26 ML per year for future predicted use at maximum production levels (mainly for product washing and processing and dust suppression). Water used in the wet

processing plant will be recirculated through a water storage dam for reuse in the plant. A breakdown of the current and predicted site water demands is included in **Table 6.6**.

Table 6.6 Annual Quarry Water Demands (ML per year) at Maximum Production Levels

Use	Existing (ML/yr)	Predicted (ML/yr)
Product washing and processing	-	8
Dust Suppression	16 (10th percentile (dry) rainfall year) 14 (50th percentile (average) rainfall year) 13 (90th percentile (wet) rainfall year)	21 (10th percentile (dry) rainfall year) 18 (50th percentile (average) rainfall year) 17 (90th percentile (wet) rainfall year)
Total	**14**	**26**

The general assumptions for **Table 6.6** above are as follows:

- For future operations, moisture content of the sand product before and after washing and processing will increase from 3.5% to 6.5% respectively. Based on 250,000 tonnes of product washed and processed on an annual basis, there will be approximately 8 ML of water added to the product per annum

- Dust suppression increases from existing to modified operations due to the increase in haul road area (approximately 1 km of haul roads for existing operations and approximately 1.3 km of haul roads for modified operations).

6.4.4.4 Site Water Balance

The water balance for the existing operations was determined based on historical rainfall and evaporation data (refer to **Section 6.3.4.2**). The existing water balance indicates that the quarry typically has a net water surplus in the order of 39 ML per year for the 50th percentile rainfall condition (refer to **Table 6.7**). The net water surplus is predicted to increase slightly to 41 ML per year with the Modification (refer to **Table 6.8**).

Table 6.7 Water Balance (ML per year)

Rainfall Condition	Existing (ML/yr)	Predicted (ML/yr)
10th percentile (dry)	-14.6	-24.1
50th percentile (average)	3.9	-2.9
90th percentile (wet)	24.3	20.6

Table 6.8 Water Balance (Average Year Results) (ML per year)

Rainfall Condition	Existing (ML/yr)	Predicted (ML/yr)
Inflows		
Rainfall/runoff	23.5	29.3
Rain on dams	18.4	19.4
Total Inflow	**41.9**	**48.7**
Demands/Losses		
Evaporation	24.0	25.2
Dust suppression	14.0	18.2
Product washing and processing	-	8.0
Total Demands/Losses	**38.0**	**51.5**
Water Balance	**3.9**	**-2.9**

The general assumptions for **Table 6.8** above are as follows:

- Rainfall runoff per hectare has been calculated based on a reduced average regional runoff rate due to seepage losses through the highly permeable sandy soils on site. The average regional runoff is 0.8 ML/ha/year for the area (determined using the NSW Department of Primary Industries Office of Water Maximum harvestable right calculator) and the runoff rate used in the water balance was 0.32 ML/ha/year (40% of the average regional runoff rate published by DPI Water for farm dam calculations). This runoff rate was determined through review of site conditions and based on the current neutral water balance for the operations.

- Dust suppression has been calculated based on usage at similar sized quarries, ranging from 0.0013 ML/m^2 for a 90th percentile rainfall year to 0.0016 ML/m^2 for a 10th percentile rainfall year.

The water balance indicates that the current quarry WMS manages approximately 41.9 ML/year of rainfall/runoff from disturbed areas (average year). As the quarry extends from the current WMS area to the proposed WMS area, the quarry WMS will capture approximately 48.7 ML/year of rainfall/runoff from disturbed areas (average year).

The water balance indicates that water demands for the approved and modified quarry operations can be met by capture of runoff from disturbed areas within the quarry WMS. Modelling indicates that the site, on average, has a close to neutral water balance.

Management of Upslope Catchment Runoff Volumes

Water balance modelling indicates that, on average, 48.7 ML of runoff will flow into the WMS from upslope (disturbed) catchment areas annually and the quarry will operate with an approximately neutral water balance for an average year. This is comparable to current approved operations with an approximate neutral water balance for an average year. During dry years the quarry will adjust production to reduce operational water demands and ensure dust suppression demands are met, or import water to the site to meet operational needs.

Historically, Dixon Sand has not needed to manage and discharge any water that is captured from upslope catchment areas. This is attributable to the highly permeable sandy soils on the site, as described in **Section 1.3.1**, where water runoff is generally only generated in significant quantities during very heavy rainfall events. As a result, the surplus water as calculated in **Tables 6.7** and **6.8** is considered to be a conservative estimate, and it is not expected Dixon Sand will need to discharge excess water as per current operations.

Dixon Sand has access to existing water bores on its local land holding and should a period of water deficit occur, these bores could be used (in accordance with appropriate licences) to provide water to the quarry operations during dry periods.

6.4.5 Surface Water Impact Assessment

To manage potential water quality impacts on downstream watercourses and users throughout the life of the quarry, it is proposed to maintain the approved WMS for the quarry and install three additional sediment basins and associated drains to manage dirty water from the proposed new extraction area and the new wet and dry processing plant area. The Modification is predicted to have negligible potential impacts on water quality on downstream watercourses due to the proposed proper design, installation and maintenance of water management infrastructure is completed in accordance with the Blue Book (refer to **Section 6.4.3.2**).

Water balance modelling indicates that the Project will not result in any water discharges from site during an average rainfall year. This is consistent with existing quarry operations where no water discharges have occurred from the operations. It is therefore considered unlikely that the proposed Modification will have any impacts on downstream flooding due to water discharge.

The WMS catchment area for Hearses Road Quarry is proposed to increase to 0.9 per cent of the total catchment area of Little Cattai Creek (as compared to 0.7 per cent for the existing operations), as such it is considered that the Modification will have negligible impact on annual downstream flow volumes and downstream water users or flooding in Little Cattai Creek.

6.4.6 Mitigation, Monitoring and Management Measures

Construction Phase

During the construction of infrastructure for the Modification all works and associated erosion and sediment controls will be inspected monthly and maintained as required to ensure that all required controls are in place and effective. In addition, all erosion and sediment controls will be designed, constructed and managed in accordance with the Blue Book Volumes 1 and 2.

Following the completion of construction works, the work areas will be inspected monthly and after any rainfall events generating runoff until revegetation and stabilisation of drainage structures are complete.

Operation Phase

During the operational phase of the Modification, inspections of the water management controls will be undertaken on a monthly basis and after storm events (i.e. greater than 50 mm rainfall in 24 hours).

The walls of all water management dams will be inspected biannually (every two years) for their structural integrity and for any maintenance requirements. The walls of the water management dams will be grassed and kept free of any trees and shrubs.

Decommissioning

As part of the decommissioning of the quarry, the water management dams will either remain in use as farm dams or will be removed and the disturbed areas rehabilitated. If the dams are to be retained, the capacity of the dams will be reviewed and the size/volume modified, if required to suit future land uses and licensing provisions (see below). Once each stage has been appropriately revegetated the proposed drainage systems will be blended in with the surrounding topography and any remaining disturbed areas will be suitably rehabilitated to ensure no runoff of dirty water. Local erosion and sediment controls (i.e. sediment fences) will be left in place until any remaining small disturbed areas achieve an appropriate level of ground cover. All buildings/workshops and associated hardstand and sealed areas will be removed and revegetated.

Surface Water Monitoring

Currently no surface water quality monitoring program is in place for the existing operations at Haerses Road Quarry. Due to the lack of water discharges, it is recommended that visual inspections of water quality be undertaken after storm events and a comment on visual water quality be included on any erosion and sediment control inspections that are undertaken. Monthly surface water monitoring of the in-pit sump is proposed to provide for ongoing monitoring of site water quality, noting that off-site discharge of water from the quarry pit is not proposed.

Water Balance

Dixon Sand proposes to monitor the site water balance through monthly monitoring of site water usage and changes in dam water volumes, to determine an annual site water balance.

Licensing Requirements

The site falls within the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* which commenced on 1 July 2011. As such, surface water within the catchment is managed under the *Water Management Act 2000*. The WMS captures water for pollution control purposes, with this water reused for construction and processing purposes. Dixon Sand does not hold any water licences under the *Water Management Act 2000* for Haerses Road Quarry.

There are several new dams proposed as part of the Modification. These dams are to be sediment dams for the primary use of pollution control. The proposed locations of these dams all fall within 1st order stream catchments. The water captured in the sediment dams will either be used for dust suppression or within the processing plant on site. As such, these dams are exempt from licensing.

Dixon Sand will continue to source water for quarry operations from within the WMS boundary and harvestable rights provisions from upslope catchment areas.

Under the *Water Management Act 2000* a controlled activity approval is required to authorise its holder to carry out a specific controlled activity at a specified location in, on or under waterfront land. Waterfront land is defined as the bed of any river, lake or estuary and any land within 40 metres of the river banks, lake shore or estuary mean high water mark. There are two first order stream lines which run through the Modification area and which will be quarried through, therefore a controlled activity approval will be required for the Modification.

6.5 Noise Assessment

A Noise Impact Assessment (NIA) has been undertaken for the Modification in accordance with the *NSW Industrial Noise Policy* (INP) (EPA 2000) and supporting application notes to the INP (EPA 2013), and with the *NSW Road Noise Policy* (DECCW 2011). The assessment considered potential noise impacts from the construction and operational phases of the Modification as well as traffic noise impacts associated with quarry related traffic travelling on public roads.

6.5.1 Existing Noise Environment

The site is located within a rural environment with typically low background noise levels. Existing noise sources include local road traffic, agricultural activities and industrial contributions from surrounding quarries.

Background noise levels surrounding Haerses Road Quarry were established by ambient noise monitoring as part of the 2005 EIS. The adopted rating background level (RBL) for receivers R1 to R4 in the 2005 EIS was 34 dB(A). A conservative RBL of 30 dB(A) has been adopted for the remaining sensitive receivers surrounding the site, representing the lowest assessable RBL under the INP. As these background noise levels existed prior to Haerses Road Quarry they are considered appropriate to use for this assessment.

6.5.2 Potentially Most Affected Noise Sensitive Receptors

A number of privately owned dwellings are located near the site. **Figure 6.11** shows the closest privately owned noise-sensitive receptors. Locations R1 to R5 were assessed as part of the original 2005 EIS. Locations R6 to R11 are additional locations identified as potentially most affected by the Modification. These dwellings are in general located on higher land, with the proposed additional extraction area located on the western side of the quarry, on sloping land facing the dwellings on the opposite side of a small valley.

Residences to the east of Hitchcock Road are associated with the PF Graham (No 2) Pty Ltd sand quarry and are covered by an agreement with Dixon Sand to waiver any potential noise impacts from the proposed development. Also, Location R2 has signed a private agreement with Dixon Sand under which the consent noise conditions do not apply.

6.5.3 Project Noise Criteria

6.5.3.1 Conditions of Approval and EPA Licence Conditions

Conditions of Approval

The noise assessment contained within the original EIS for Haerses Road Quarry assessed noise from operations within the site in accordance with the INP. The consent contains a number of conditions specifically related to noise levels at the nearby receptors.

The key consent conditions relating to noise, including specific noise limits, are as follows:

[1]**NOISE**

Note: The Applicant is required to obtain a licence for the development under the Protection of the Environment Operations Act 1997.

Noise Impact Assessment Criteria

5. The Applicant shall ensure that the noise generated by the development does not exceed the noise impact assessment criteria in Table 1.

Table 1: Noise impact assessment criteria dB(A)

Day	Shoulder (6am to 7am)		Land
$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A(max)}$	
37	37	45	1. F & J Roberts and J & D Young
40	40		2. E. Ramm
38	38		3. M. Ramm
37	37		4. B Ramm
35	35		All other residences on privately owned land

Monitoring

10. Prior to carrying out any development, the Applicant shall prepare (and following approval implement) a Noise Monitoring Program for the development, in consultation with the DEC, and to the satisfaction of the Director-General. This program must include a combination of attended and unattended noise monitoring and a noise monitoring protocol for evaluating compliance with the noise impact assessment criteria in this consent.

EPA Licence Conditions

EPL 12513 includes limits on the noise generated from the quarry. These limits, outlined in Condition L6.1 are the same as the consent noise limits above.

6.5.3.2 Project Adopted Operational Site Noise Criteria

As an existing operation looking to modify its consent, the Modification at Haerses Road is assessable under Section 10 of the INP. The approach being adopted in this assessment for the purpose of the Modification is to seek to achieve compliance with the current consent noise limits based on the implementation of reasonable and feasible measures, as appropriate.

Accordingly, the noise criteria for operational noise emanating from the site adopted for the Modification (and based on existing consent noise limits) are set out in **Table 6.9**.

Table 6.9 Modification Operational Site Noise Criteria

Receiver	Day	Shoulder Period (6am to 7am)	
	L_{Aeq} , 15 minute	L_{Aeq} , 15 minute	$L_{A\ max}$
R1	37	37	45
R3	38	38	

Receiver	Day LAeq , 15 minute	Shoulder Period (6am to 7am)	
		LAeq , 15 minute	LA max
R4	37	37	
All other receivers without private agreement	35	35	

Note: R2 is subject to a private agreement relating to noise, therefore is not considered a sensitive receiver for the purpose of this NIA.

6.5.3.3 Road Traffic Noise Criteria

The Department of Environment, Climate Change and Water (DECCW) (now EPA) NSW Road Noise Policy (RNP) (DECCW 2011) sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments or planned building developments.

Direct access to and from the site is via Wisemans Ferry Road, which intersects with Old Northern Road to the west.

Table 6.10 outlines the road traffic noise criteria that would be applicable on Wisemans Ferry Road and Old Northern Road. Under the road category definitions provided in Table 2 of the RNP, these roads are considered to fall under the functional road category of arterial/sub-arterial roads.

Table 6.10 Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, 15 hour 60 (external)	LAeq, 9 hour 55 (external)

Where the prevailing noise levels are already higher than the criteria, Section 3.4 of the RNP notes that when assessing noise impacts and the effectiveness of feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

Furthermore, specifically relevant to traffic generated by new land use developments, Section 3.4.1 of the RNP states that for existing residences and other sensitive land uses affected by additional traffic on existing roads, any increase in the total noise level should be limited to 2dB above that of the corresponding level without the project. This is applicable when the noise criteria are exceeded in any time period.

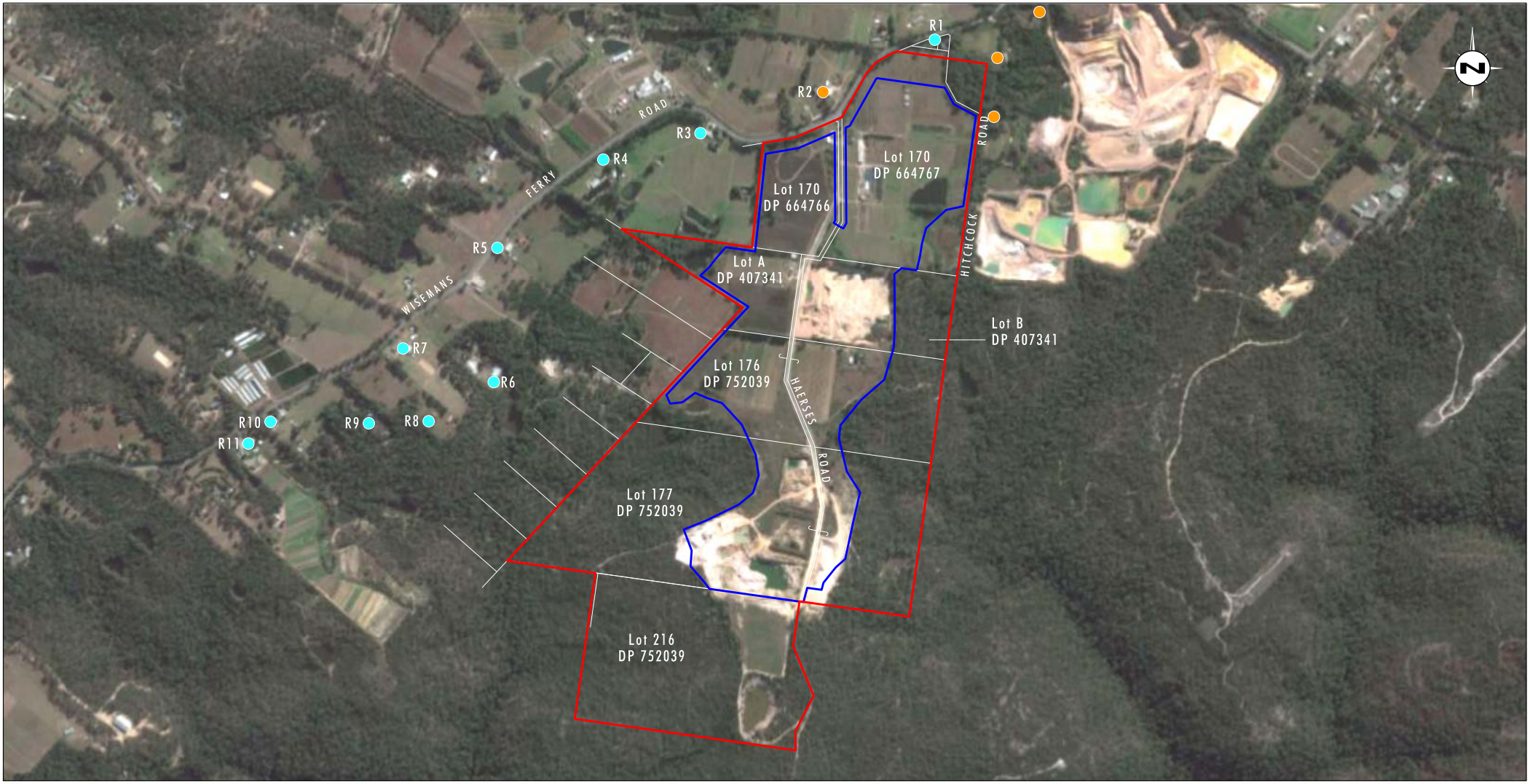

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Noise Receiver Location
- Noise Receiver with Private Agreement

FIGURE 6.11

Haerses Road Quarry
Noise Receiver Location

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6.5.3.4 Construction Noise Criteria

The EPA recognises that construction activities could potentially generate higher noise levels than those of typical industrial operations. The Department of Environment and Climate Change (DECC) (now EPA) Interim Construction Noise Guideline (ICNG) (DECC 2009) provides noise management criteria for construction activities. The criteria presented in **Table 6.11**, are intended to guide the need for and the selection of feasible and reasonable work practices to minimise construction noise impacts.

Table 6.11 Construction Noise Management Levels at Residences, dB(A)

Construction Time	Management Level, $L_{Aeq,15\ minute}$
Recommended standard hours Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Noise Affected: Rating Background Noise Level + 10 dB
	Highly Noise Affected: 75 dB(A)
Outside recommended standard hours	Noise Affected: Rating Background Noise Level + 5 dB

Based on the above and the adopted RBLs of 34 dB(A) for Locations R1 to R4 in the 2005 EIS (established from ambient noise monitoring) and a conservatively assumed RBL of 30 dB(A) (i.e this is conservative as it represents the minimum recommended RBL based on EPA procedures) at other locations (i.e Locations R5 and above), the corresponding Modification construction Noise Management Levels are outlined in **Table 6.12**.

Table 6.12 Construction Noise Criteria, dB(A)

Receiver Description	Management Level, $L_{Aeq,15\ minute}$	
	Standard hours (based on day-time RBL)	**Outside Standard Hours** (based on night-time RBL)
Locations R1 to R4	44	39
Locations R5 and above	40	35

Note: R2 is subject to a private agreement relating to noise, therefore is not considered a sensitive receiver for the purpose of this NIA.

The construction noise management levels for the non-sensitive receivers such as other industrial operations is 75 dB(A).

6.5.4 Modelling of Site Noise

6.5.4.1 Modelling Software

Computer noise modelling was undertaken based on the CONCAWE (Conservation of Clean Air and Water in Europe) industrial noise algorithm as implemented in the CadnaA environmental noise software package. CONCAWE is an internationally recognised algorithm used in the prediction of environmental noise from industrial complexes. The software utilises terrain data, source and receptor locations and heights, source sound power levels and input meteorological conditions to predict noise levels. The software accounts for ground effect, source sound power levels, geometric spreading, air absorption, acoustic shielding from topography and barriers as well as meteorological enhancement in its predictions.

6.5.4.2 Noise Modelling Parameters and Scenarios

Meteorological factors such as source to receptor winds and temperature inversions can enhance the propagation of noise. The INP requires noise modelling to include prevailing noise enhancing meteorological conditions which are considered to be a feature of the area. In terms of wind, a prevailing wind direction (i.e. up to 3 m/s) is defined to be that which occurs from a given direction for 30% of the time or more in any daytime, evening or night time period, in any single season. Similarly, temperature inversions are considered to be a feature of an area if they occur for 30% or more of the night time period in the winter months, where operations occur during the night time period.

An analysis of hourly samples of wind data collected for contiguous years between January 2002 and January 2005 at the Bureau of Meteorology Richmond (RAAF Base) weather station was undertaken as part of the noise study for the 2005 EIS. No prevailing wind directions were identified as a feature of the area within the operating hours. Furthermore, as part of the air quality study for this proposed Modification, analysis of recent wind data collected in the local area at Maroota Public School was also undertaken. Winds were found to be typically light, with a relatively high percentage of calm periods. A similar pattern of wind directions was found when compared with data from the Bureau of Meteorology in Richmond, with a worst-case easterly wind occurring for approximately 14% of the time during summer. This is a relatively low degree of occurrence and it is therefore concluded that assessment under prevailing source to receiver winds is not applicable under the INP. Accordingly, consistent with the approach of the approved 2005 EIS, noise modelling was carried out for still, isothermal (i.e calm) conditions (Pasquill Stability Class D, 20^{o}C and 70% humidity).

LIDAR derived topography data was utilised within the modelling.

Plant and equipment currently used on site is as follows:

- 1 x Komatsu 375A dozer
- 1 x Caterpillar 972G front end loader
- 2 x 30 tonne dump trucks
- 1 x water cart
- 1 x Caterpillar 12G grader (irregularly)
- 1 x service vehicle (irregularly)
- 1 x mobile dry screening plant.

In addition to the above plant and equipment currently used on site, as part of the Modification, two mobile crushers (one rotary and one jaw crusher) would be required to pre-process material prior to screening and one new wet processing plant would be installed at the southern extent of the site.

The sound power levels utilised in the noise modelling are presented in **Table 6.13** and are generally based on information contained within the Umwelt database with reference to the UK Government's Department of Environment, Food and Rural Affairs construction noise database and Umwelt's experience of similar operations and equipment and previous projects.

Table 6.13 Noise Source Sound Power Levels, dB(A)

Noise Source	Sound Power Levels
30t Dump Truck	112
Dozer	109
Product Trucks	108
Water Cart	112
Grader	106
Front End Loader	108
Wet Processing Plant	96
Crushers (jaw and rotary) and Screen Unit	116
Product Truck Idling	98
Dump Truck Idling	102

Note: Wet Processing Plant source height is 4m above local ground level. Source height of all other sources is 2m above local ground level.

6.5.4.3 Incorporated Noise Mitigation Measures

The INP requires the implementation of reasonable and feasible noise mitigation measures to meet and minimise any exceedances of noise criteria. This approach was utilised to establish noise mitigation measures incorporated in the modelling. An iterative process of noise modelling, optimisation and refinement was used to investigate and optimise possible options.

The original requirement was for the crushers and screen to be operated within the extraction areas. This resulted in relatively high noise levels in the two northern extraction cells (Cell 4 and 5), requiring high and impracticable bund heights in the order of 9m running north to south along the cell width to be constructed every 100m from the western boundary to the eastern boundary. This is because of the interaction of the relatively high noise levels generated by the crushers and screen, dwellings located on relatively high land opposite the site and the downward slope of the land from east to west on site providing minimal topographic screening. In light of this, the following alternative feasible and practicable option has been adopted and incorporated in the noise modelling, consistent with the reasonable and feasible methodology recommended under the INP:

- construct a minimum 7 metre high bund (or combined bund / noise fence) along the western boundary of Cell 4, with a minimum 80 metre return along the northern boundary of the cell prior to early extraction works in Cell 4
- construct a minimum 7 metre high bund (or combined bund / noise fence) set back a minimum of 50 metres from the western boundary of Cell 5 prior to early extraction works in Cell 5.
- either one of dozer or front end loader (not both) to operate in Cell 4 and Cell 5 during early extraction, clearing or construction of bund walls, to minimise noise
- during early extraction works (at or near surface level) in Cell 4 and Cell 5, product to be stockpiled and hauled away separately so that extraction does not occur simultaneously with haulage.

6.5.4.4 Predicted Noise Levels

Daytime Operations

The additional extraction area is located on terrain that slopes downwards from east to west. This drop-of continues progressively further west of the site boundary before rising again. The potentially most affected receivers are generally located on higher ground to the west of the proposed extraction area.

Table 6.14 presents predicted indicative typical worst case noise levels with the incorporated noise control measures outlined in **Section 6.5.4.3**. No modification factors are deemed necessary with reference to INP procedures.

Table 6.14 Predicted $LA_{eq,15minute}$ Daytime Noise Levels, dB(A)

Location	Criteria LA_{eq} , 15 minute	Cell 4, Early Extraction [1]	Cell 5, Early Extraction [1]	Cell 1, Clearing, Pre-stripping and Early Extraction [1, 2]	Cell 3, Clearing, Pre-stripping and Early Extraction [1, 2]	Cell 4, Bund Construction [1]
R1	37	41	31	31	31	31
R2[3]	40	43	43	43	43	43
R3	38	34	34	34	34	34
R4	37	35	34	34	35	35

Location	Criteria LA_{eq}, 15 minute	Cell 4, Early Extraction [1]	Cell 5, Early Extraction [1]	Cell 1, Clearing, Pre-stripping and Early Extraction [1, 2]	Cell 3, Clearing, Pre-stripping and Early Extraction [1, 2]	Cell 4, Bund Construction [1]
R5	35	35	34	34	35	35
R6		36	37	32	33	40
R7		34	36	34	36	34
R8		36	36	36	36	36
R9		35	35	35	35	35
R10		33	33	33	33	34
R11		33	32	32	33	33

1 - Product truck movement on Haerses Road modelled for all scenarios.
2 - Dump truck haulage to the Wet Processing Area modelled
3 - Location R2 is covered by a private agreement with Dixon Sand under which the consent noise conditions do not apply, however it has been included in the table for completeness

Noise modelling was carried out for the representative worst case scenarios, as shown in **Figure 6.12**. The plant and equipment were moved about the extraction areas in an iterative process to identify the locations that would represent typical worst case conditions. This is not necessarily when plant is at the westernmost point (i.e. closest to the site boundary and dwellings) due to the interaction of distance, some acoustic shielding from local topography in areas, elevation of source and receivers and the acoustic shadow zone of the earth bund walls. Moving point sources were used to represent dump (haul) truck movements (8 trips per hour) along the haul road to/from the relevant extraction cells to the wet processing area and product trucks accessing the wet processing area on site via Haerses Road (a conservative 20 movements per hour).

As can be seen from the results presented in **Error! Reference source not found.14**, other than Location R2 which is covered by a private agreement with Dixon Sand under which the consent noise conditions do not apply, noise levels during early near surface level extraction in Cells 1 and 3 are predicted to marginally exceed the consent noise limits by 1 dB(A) at locations R7 and R8. Similar noise levels are expected in Cell 2. This minor degree of exceedance would barely be perceptible. Similar noise levels can be expected during clearing and pre-stripping operations.

In Cell 4 and Cell 5, noise levels during at surface and early near surface level extraction (and later stages of pre-stripping when carried out behind the bund wall) are predicted to marginally exceed the noise limits by up to 2 dB(A) at the nearest receivers.

During the clearing and stripping operations in Cells 4 and 5, both of which are relatively short term operations which would be conducted on a campaign basis, noise levels of 40 dB(A) are expected at the worst affected location nearest to the site.

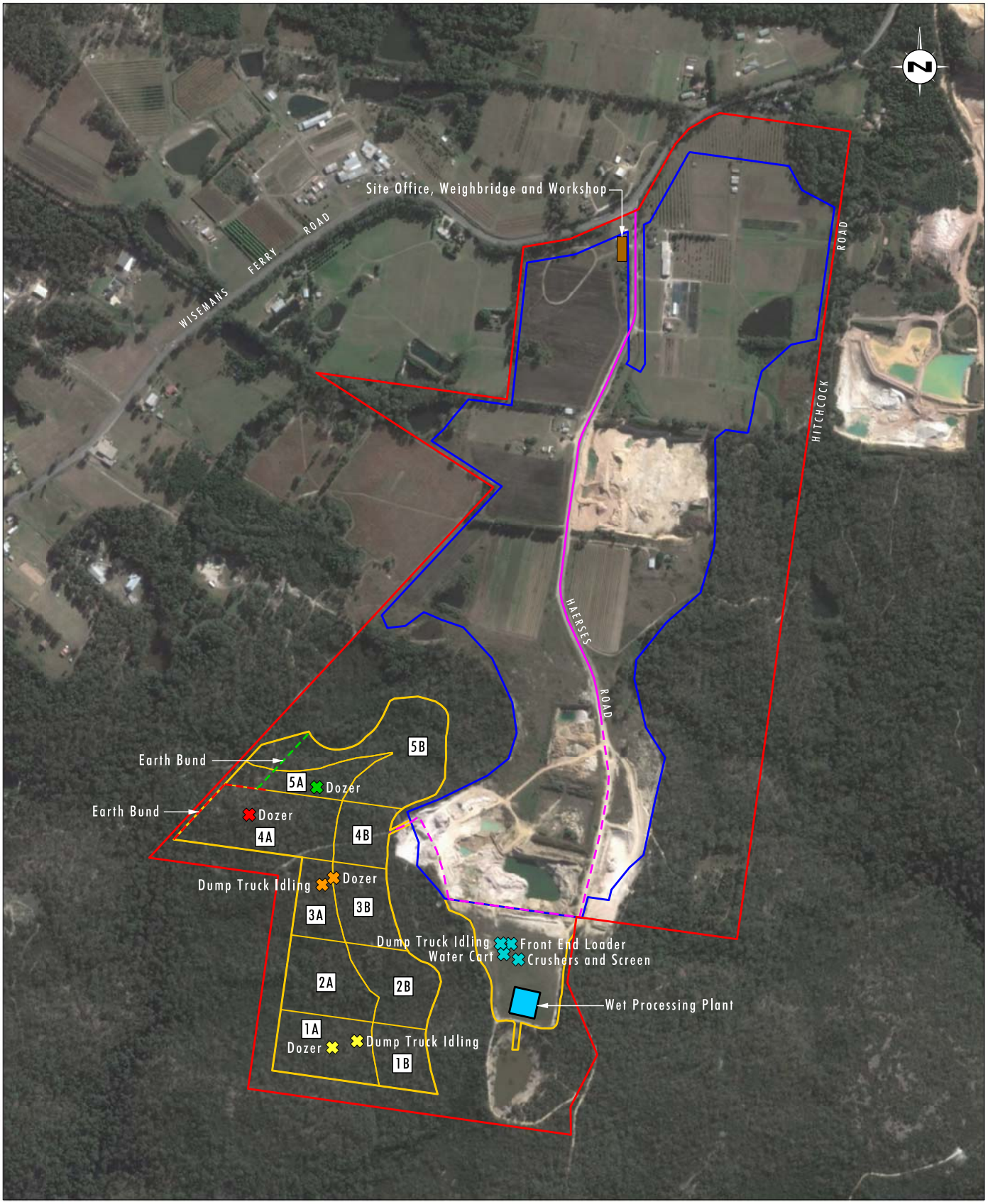

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- 1 Extraction Cell Number
- Site Office, Weighbridge and Workshop
- Wet Processing Plant
- Indicative Unsealed Haul Road
- Sealed Haul Road
- Cell 4 Earth Bund
- Cell 5 Earth Bund

Source Locations:

- Early Extraction Cell 1
- Early Extraction Cell 3
- Early Extraction Cell 4
- Early Extraction Cell 5
- Other Sources

FIGURE 6.12

Source Locations

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Discussion of Daytime Noise Levels

Locations directly affected by changes due to the Modification (i.e. by noise from works in the additional extraction area and wet and dry processing area) are isolated to Locations south of R5, closest to these work areas.

In relation to early extraction noise when plant is near surface level, marginal exceedances of 1 dB(A) to 2 dB(A) would be barely perceptible and considered acceptable particularly given that reasonable and feasible mitigation measures have already been implemented. Furthermore, noise levels will progressively reduce as the extraction pit depth is increased and the dozer (or front end loader) will be more effectively shielded by the working face of the pit, which would potentially be well over 10m during later stages of extraction.

It is noted that the INP (refer Section 11.1.3) considers that a development will be deemed to be in non-compliance with a noise consent or licence condition if the monitored noise level is more than 2 dB above the statutory noise limit specified in the consent or licence condition. Should greater exceedances be experienced, further noise management and mitigation measures would be investigated. Some examples of measures that can potentially be investigated in this event include temporarily shutting down some equipment/operations and construction of intermediate bund walls within the extraction cells. Other potential measures that may assist are outlined in **Section 6.5.7.**

During clearing, pre-stripping and construction of the earth bund in Cell 4 and Cell 5, noise levels of up to 40 dB(A) may be expected. These activities are a necessary part of the operation and are unavoidable. Furthermore, construction of the bund walls are required to mitigate noise levels from the longer term extraction phase. However, these activities would be of relatively short-term duration and would be carried out on a campaign basis in a similar manner as is being undertaken for other stages of the approved development at present. It is expected that the duration for clearing and construction of the bund within a cell would typically be in the order of four weeks. Although construction noise criteria would typically not be applicable in this situation given that the activity is not a clearly defined activity that would be carried out at the start of the project but one that would be carried out at various stages throughout the project, it is of note that the noise levels are expected to comply with the construction noise criteria at the nearest dwellings. In view of the relatively short duration of land clearing, early pre-stripping and bund construction works, it is recommended that best management practices be adopted to minimise noise impacts where possible.

Measures that will be implemented during this phase of works include:

- consultation with the nearest residents prior to work commencement advising them of the potential for elevated noise levels during surface works and bund construction, the timing of works, duration and taking into consideration times that might be of least disturbance to them

- provision of a site contact and telephone number to raise any concerns during the works.

Loading and Transportation during Morning Shoulder Period

Error! Reference source not found.15 shows the predicted noise level in the morning shoulder period between 6am and 7am during loading activities in the wet processing area at the closest and potentially most affected residential receivers (this being a new activity proposed as part of the Modification). The noise modelling includes product trucks accessing the wet processing area and the front end loader loading operations in the wet processing area.

Table 6.15 Predicted $LA_{eq,15minute}$ Noise Levels during the Morning Shoulder Period, dB(A)

Location	$LA_{eq,15minute}$ Noise Level	LA_{max} Noise Level*
R1	30	23/23/21
R2	43	27/27/26
R3	33	27/27/26
R4	32	33/33/32
R5	<30	34/34/33
R6	<30	32/32/30
R7	<30	34/34/33
R8	<30	36/35/34
R9	<30	34/34/33
R10	<30	32/32/30

*L_{max} noise levels associated with Truck/FEL/Reversing Alarm. L_{max} sources located in the Wet Processing Area

As demonstrated by **Table 6.15**, predicted noise levels from operations attributable to this Modification during the morning shoulder period are well within the stipulated consent and EPL limits as a result of the lower intensity of operations during the morning period and relatively large setback distances to the potentially most affected receivers.

6.5.5 Road Traffic Noise

As discussed in the Traffic Impact Assessment prepared by SECAsolution (refer to **Appendix 4**), the current consent does not seek to alter the overall number of truck movements in and out of the site (28 per day), but rather seeks to alter the potential truck movement patterns which currently restrict trucks to a maximum of 7 truck movements to the south-west per day and increase this up to a maximum of 28 per day corresponding to the currently approved maximum number of trucks entering the site. Furthermore, in the morning period between 6am to 7am, the current consent restricts traffic entering the site to 10 trucks, which will not change. Based on the 7 truck restriction to the south-west, this conservatively implies up to 17 movements to/from the south-west during the 6am to 7am period. Under this modification proposal, in a worst case scenario, this could potentially increase by up to 3 additional movements to 20 movements, relative to the current situation of up to 17 movements.

The area adjacent to the site and further west of the site is typically rural, with dwellings on large blocks of land and generally well set back from the road. However there are some dwellings at closer proximity to the road, in the order of 20m.

Based on peak hour traffic surveys, the Traffic Impact Assessment estimated the daily traffic flow on Wisemans Ferry Road to the west of the site at approximately 1,800 vehicles per day. Furthermore, with guidance from the project traffic consultant, an estimated traffic split of 90% during the 15 hour daytime period and a heavy vehicle content of 10% of the current traffic volume at a traffic speed of 80 km/h (based on the posted speed) is assumed. During the night-time period (which includes the 6am to 7am period), a 5% heavy vehicle content is assumed. **Table 6.16** shows the calculated facade road traffic noise levels

based on UK Department of Transport's Calculation of Road Traffic Noise (CoRTN) 1988 road traffic noise algorithms. It has also been conservatively assumed, for a worst case analysis, that the maximum possible upper limit of 20 project related truck movements per day would occur along Wisemans Ferry Road between 6am and 7am (i.e. three more than could occur currently) and up to 56 truck movements could potentially occur over the rest of the day. This is a worst case analysis as in reality, a proportion of traffic can reasonably be expected to travel to the north, as is now the case with the majority of traffic under the current consent.

Table 6.16 Predicted Road Traffic Noise Levels, dB(A)

Distance from Road, m	Day (7am to 10pm)		Night (10pm to 7am)	
	Current Noise Level	Noise Level with Modification	Current Noise Level	Noise Level with Modification
20	58	59	50	52
30	56	56	48	50
Criteria	**60**		**55**	

Note: CoRTN noise levels incorporating local Australian adjustment of -3 dB(A) for L_{A10} to L_{Aeq} and -1.7 Australian Road Research Board (ARRB) adjustment for local conditions.

As shown in **Table 6.16**, road traffic noise levels are predicted to comply with the nominated RNP noise criteria during both day and night periods with even lower noise levels at greater offset distances typical of a rural environment.

6.5.6 Construction Noise

A weighbridge, office and maintenance shed are proposed to be constructed on site as part of the Modification. The nearest private dwellings are located approximately 70m to the north and over 300m to the east (R1) and west (R2) along Wisemans Ferry Road. Of these, the dwelling to the north (R2) is covered by a private agreement related to noise associated with the development. In any case, noise associated with these construction works is anticipated to be of relatively low intensity particularly in comparison with the ongoing sand extraction and transportation activities on site. For example, relatively few construction-related delivery trucks (compared to up to 56 operational truck movements per day) would potentially be used to transport raw materials to site and a mobile crane may be used to assist in the construction. Noise levels from these and associated activities are expected to easily comply with the construction noise criteria.

6.5.7 Noise Management

The measures outlined in **Section 6.5.4.3** will be incorporated into the Modification in order to minimise noise from the quarry.

Haerses Road Quarry currently has an Environmental Management Program which outlines the noise monitoring requirements. The Environmental Management Plan will be modified to incorporate additional noise monitoring at the potentially most affected locations near the south-western end of the site, such as Location R6 and R8, when extraction operations are being conducted in the additional extraction area.

Further to the above, a Noise Management Protocol will be prepared and implemented prior to commencing campaign works such as clearing of the extraction cells, early pre-stripping works and construction of the noise bunds. Measures to be included in the Protocol are:

- consultation with the nearest residents prior to work commencement advising them of the potential for elevated noise levels, the timing of works, duration and taking into consideration times that might be of least disturbance to them

- provision of a contact and telephone number to raise any concerns during the works.

There are a number of additional noise control measures or operational procedures available for consideration on an as-needed basis to assist in managing noise emissions on site. The implementation of these measures or operating procedures may depend on operational and meteorological conditions. Additional noise management measures that will be considered include:

- utilising stockpiles located between near surface loading activities in the extraction cells and nearest receivers (in particular R6 and R8), where this is possible

- in the wet processing plant area, locate stockpiles along the western boundary of the area to shield loading/unloading activities. In particular, locating stockpiles as close as possible to the crushers and screen, between these plant items and the nearest receivers (in particular R6 and R8) would be beneficial, if possible

- construction of the earth bund walls in Cell 4 and Cell 5 as early as possible following clearing and early pre-stripping so that subsequent pre-stripping works at the western end of the extraction cells will benefit from the acoustic shielding provided by the bund walls

- when excavating within the extraction pits, where and when possible, excavation should be such that the western excavation face is the working face. This maximises acoustic shielding

- where noise from the dry and wet plant is found to be directional, orientate the plant so that the quieter direction is towards the closest and most affected receptors (e.g. R6 and R8), where this is feasible

- switch engines on mobile plant off when stationary rather than on idle

- make operators of mobile plant aware of measures to minimise impacts on sensitive recievers, particularly during operations in Cells 4 and 5, and provide adequate training so that quiet operating procedures can be implemented, where feasible and reasonable .

6.6 Air Quality

A detailed Air Quality Assessment has been prepared for the Modification by Pacific Environment Limited in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (NSW DEC, 2005). The Air Quality Assessment is provided in **Appendix 5** with the results summarised in this section of the EA.

6.6.1 Existing Air Quality Environment

The quarry is located in an area that is primarily rural, although significant sand extraction activity is also taking place in the area both by Dixon Sand and other companies. The closest sensitive receptor locations are presented in **Figure 6.13**. These residential receivers (some of which are owned by Dixon Sand and PF Formation, as indicated) represent assessment locations in close proximity to the Modification.

Air quality standards and goals refer to pollutant levels which include the contribution from proposed projects as well as other sources. To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which a project is likely to contribute to these levels. Dixon Sand measures particulate matter at Maroota Public School approximately 2 kilometres north of the Haerses Road Quarry, and dust deposition on site at the Haerses Road Quarry. There are also several other dust deposition monitoring locations in the local area associated with other quarries.

For the purposes of assessing potential air quality impacts, the following existing air quality levels are assumed based on review of monitoring data for assessment against the long-term criteria:

- annual average PM_{10} concentrations of 13 µg/m^3
- annual average $PM_{2.5}$ concentrations of 6.2 µg/m^3
- annual average TSP concentrations of 32.5 µg/m^3
- annual average dust deposition of 2.1 g/m^2/month.

Wind speed and direction data collected from Maroota Public School show predominant winds are from the north, east and south-west quadrants and are generally light with an average wind speed of 1.2 m/s. There is also a relatively high percentage of calms (wind speeds below 0.5 m/s) at 16.5%. Wind data from 2015 has been found to be generally representative of the larger data set in terms of average wind speed, percentage of calms and directional patterns and has therefore been selected to represent the meteorology of the Modification area in the air quality assessment.

6.6.2 Air Quality Criteria

The air quality assessment criteria adopted for the Modification are consistent with those recommended by the EPA and specified in the Approved Methods (NSW DEC, 2005). These criteria are health-based (i.e. they are set at levels to protect against health effects) and for PM_{10} are consistent with the now superseded *National Environment Protection Measure for Ambient Air Quality* (referred to as the Ambient Air-NEPM) (NEPC, 1998a). However, the Approved Methods include other measures of air quality, namely dust deposition and TSP which are not stated in the Ambient Air-NEPM.

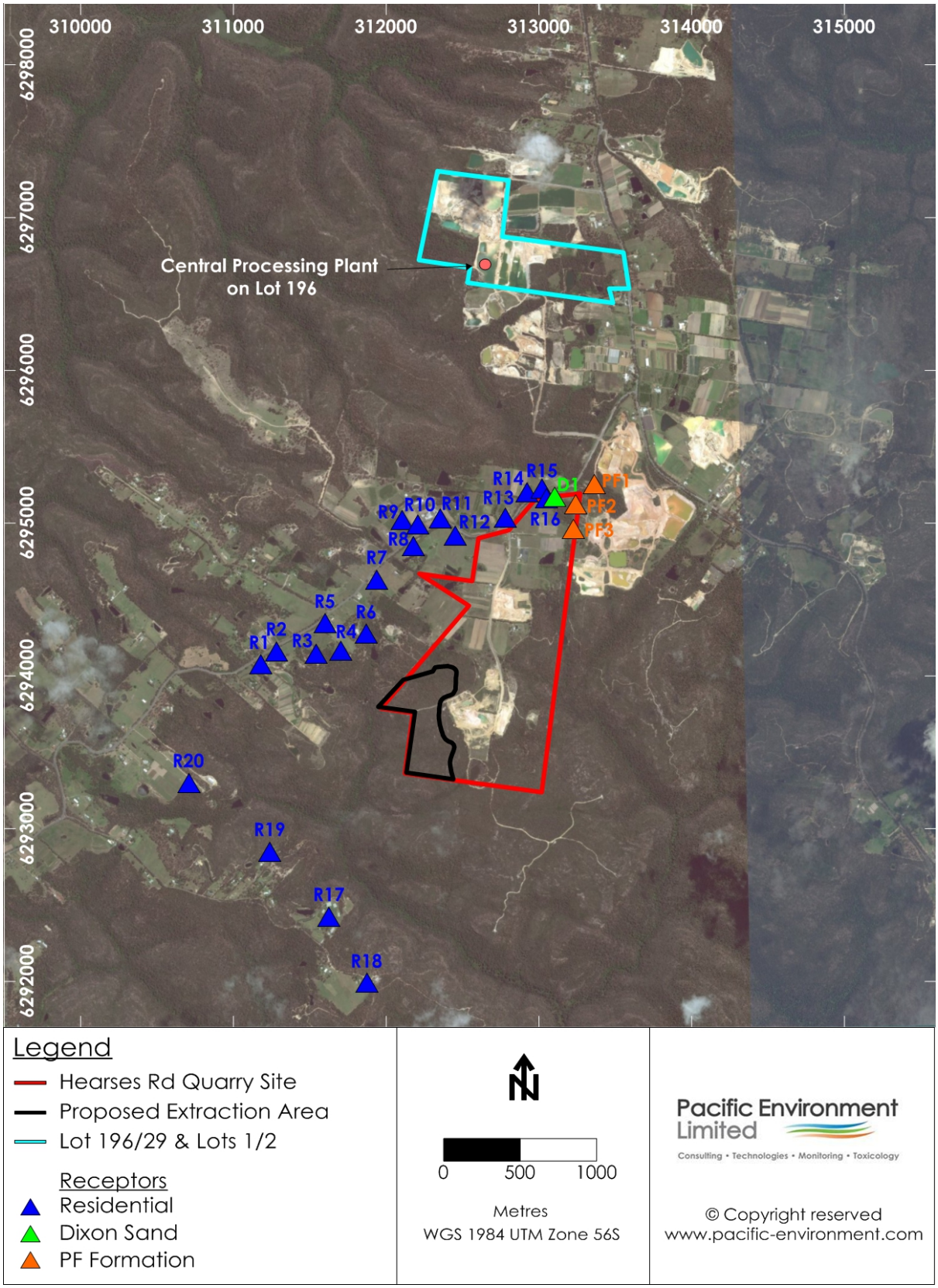

Figure 6.13 Location of Air Quality Assessment Sensitive Receptors

Source: Figure 3.1 Dixon Sand Haerses Road Modification – Air Quality Assessment (Pacific Environment, 2016)

The NEPC released an amended Ambient Air NEPM in January 2016 (NEPC, 2016) that takes into account the latest scientific evidence about the health impacts of particles. The amendment changed the 'advisory reporting standards' status for annual average and 24-hour average $PM_{2.5}$ (particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less) to 'standards'. The 2016 NEPM for $PM_{2.5}$ standards have been used in this report for comparison against dispersion modelling results.

Air quality standards for relevant pollutants are included in **Table 6.17**. It is important to note that the criteria are applied to the cumulative impacts due to the Modification and other sources.

Table 6.17 NSW EPA Air Quality Standards for Particulate Matter Concentrations

Pollutant	Standard	Averaging Period	Source
TSP	90 µg/m^3	Annual	NSW DEC (2005) (assessment criteria)
PM_{10}	50 µg/m^3	24-Hour	NSW DEC (2005) (assessment criteria)
	30 µg/m^3	Annual	NSW DEC (2005) (assessment criteria)
$PM_{2.5}$	25 µg/m^3	24-Hour	NEPC (2016)
	8 µg/m^3	Annual	NEPC (2016)

Notes: µg/m3 – micrograms per cubic metre.

In addition to health impacts, airborne dust also has the potential to cause nuisance effects by depositing on surfaces, including vegetation. Larger particles do not tend to remain suspended in the atmosphere for long periods of time and will fall out relatively close to source. Dust deposition can soil materials and generally degrade aesthetic elements of the environment, and are assessed for nuisance or amenity impacts. **Table 6.18** shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust deposition are set to protect against nuisance impacts (NSW DEC, 2005).

Table 6.18 EPA Criteria for Dust (Insoluble Solids) Fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Crystalline Silica

Dust generated from the Modification may contain silica dust. Long-term exposure to high levels of respirable crystalline silica (RCS) in the work place may result in silicosis, a serious lung disease. The World Health Organization's *Concise International Chemical Assessment Document on Crystalline Silica, Quartz* (CICAD, 2000) states that "there are no known adverse health effects associated with the non-occupational exposure to quartz". In addition, an Australian Government Senate Committee (2005) report identified that there are no reports in the international literature of individuals developing silicosis as a result of exposure to non-occupational levels (i.e. levels outside the work place) of silica dust, and an expert appearing before the committee confirmed the potential for such an occurrence as being very remote.

A literature review on the potential impacts to health from exposure to crustal material in Port Hedland, WA, states "exposure to airborne quartz carries the risk of silicosis, but only with prolonged exposure to concentrations greater than 200 µg/m^3" (Department of Health, 2007). As detailed in **Section 6.6.4** the maximum cumulative annual average PM_{10} concentrations (of which RCS would be a small fraction) at the most affected residence is predicted to be 14.7 µg/m^3 (of which 13 µg/m^3 is due to existing background levels), significantly below levels that may be of concern. For this reason, RCS has not been considered further in this assessment.

6.6.3 Assessment Methodology

The overall approach to the assessment generally follows the Approved Methods (NSW DEC, 2005) using the Level 2 assessment methodology.

Modelling System

AERMOD was chosen as the most suitable model due to the source types, location of nearest receivers and the nature of the local topography as well as being an accepted model of the NSW EPA.

Operational Scenarios

Generally dry and wet processing will occur at the processing area shown on **Figure 1.3**, however dry processing (screening and crushing) could potentially occur within the extraction pits once the pit is deep enough to provide sufficient acoustic screening. Both scenarios have been assessed:

- Scenario 1 – dry and wet processing at the processing location
- Scenario 2 – dry processing in pit, wet processing at processing location.

6.6.4 Air Quality Impact Assessment

Air quality standards and goals include the pollutants from all sources, inclusive of those expected as a result of the Modification. This assessment includes data gathered on existing dust concentration and deposition levels in the area in which the Modification is likely to contribute. Dust emissions during operation of the modified quarry have been estimated based on activities and equipment that would be operating at the site. The full emissions inventories for general operations, worst case operations and source locations are presented in **Appendix 5** along with a summary of the predicted pollutant concentrations at each of the assessment locations and contour plots showing the full suite of modelling results.

For all of the potential pollutants the results indicate that the incremental increases from the Modification on an annual and worst case operational basis, when added to the background concentrations outlined in **Section 6.6.1**, are below the respective EPA criteria for particulate matter and dust deposition. Note that the results for Scenario 2 are comparable to Scenario 1 in each case and therefore Scenario 1 is discussed specifically below.

Incremental Impact Assessment

The predicted particulate matter concentrations and dust deposition levels due to emission from the Modification alone are summarised as follows:

- **PM_{10}** - There are no privately owned receptors that are predicted to experience ground level concentrations (glcs) of PM_{10} above the assessment criteria, due to emissions from the Modification

only. The highest predicted glcs occur at R1, where the predicted incremental 24-hour PM_{10} concentration is 30.8 µg/m^3. The predicted annual average PM_{10} concentration at this receptor is 1.3 µg/m^3. Contour plots for PM_{10} annual and 24 hour worst case day operations are shown in **Figures 6.14** and **6.15** respectively.

- **$PM_{2.5}$** - There are no exceedances of the relevant 24-hour and annual average criteria predicted beyond the site boundaries. There are no privately owned receivers that are predicted to experience glcs of $PM_{2.5}$ above the assessment criteria, due to emissions from the Modification only. The highest predicted glc occurs at the R6, where the predicted incremental 24-hour $PM_{2.5}$ concentration is 5.7 µg/m^3 and the predicted annual average $PM_{2.5}$ concentration is 0.4 µg/m^3.

- **TSP** - There are no privately owned receptors that are predicted to experience glcs of TSP above the assessment criteria, due to emissions from the Modification only. The highest predicted glc occurs at R4, where the predicted incremental annual average TSP concentration is 1.5 µg/m^3.

- **Dust deposition** - There are no privately owned receivers that are predicted to experience glcs of dust deposition above the assessment criteria, due to emissions from the Modification only. The highest predicted glc occurs at receptors 1, 3 and 13. At these locations, the predicted incremental annual average dust deposition concentration is 0.04 g/m^2/month.

Cumulative Impact Assessment

In order to assess the cumulative impacts of the Modification on local air quality, predicted 24-hour average PM_{10} and $PM_{2.5}$ concentrations for the Modification alone were added to existing 24-hour average background data from Maroota Public School (for PM_{10}) and NSW EPA stations at Wyong and Richmond (for $PM_{2.5}$). The assessment was conservatively completed for the worst case day operations at the four most impacted receivers as a result of the Modification (R1, R2, R6, and R18).

24-Hour Average PM_{10}

The results indicate that for the four receptors assessed, there is potential for a maximum of four additional exceedances of the cumulative 24-hour PM_{10} impact assessment criteria of 50 µg/m^3 per year for the most affected receiver (R1). However the percentage of time when the incremental concentration at R1 is over 2 µg/m^3 is less than 1% of the modelled period, highlighting the relatively minor impact of the Modification on the existing background particulate matter in the area. Therefore it is considered that only under worst case meteorological conditions combined with high background concentrations of particulate matter will an exceedance of the criteria potentially occur.

For PM_{10}, if the worst day operations happened to coincide with already elevated background concentrations, the relevant criteria may be exceeded. However this outcome is considered unlikely to occur and with the current Dixon Sand EPL requirement to modify/cease operations if rolling 24-hour averages exceed 42 µg/m^3, this will minimise the potential for this to occur even further.

24-Hour Average $PM_{2.5}$

The result indicate that the Modification would be unlikely to result in any days over the impact assessment criteria of 25 µg/m^3, and that the Modification would have a very minimal impact on current $PM_{2.5}$ concentrations. It is noted that R18 has been predicted to have one exceedance over the 2015 period, however this correlates with the highest background concentration and incremental increase, and hence the air quality impact is considered minor.

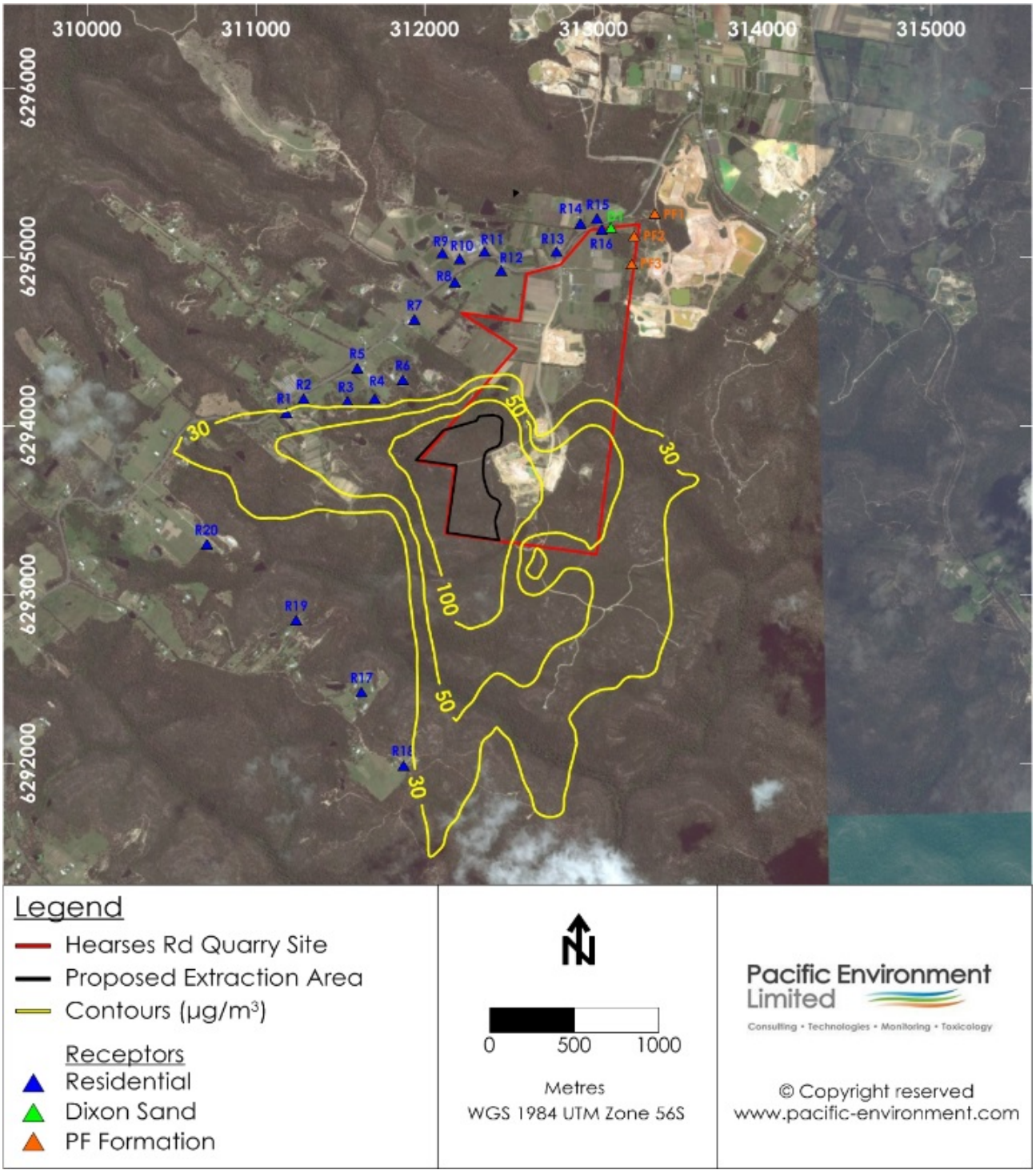

Figure 6.14 Annual Operations Maximum 24-Hour PM10 Concentration

Source: Figure 7.1 Dixon Sand Haerses Road Modification – Air Quality Assessment (Pacific Environment, 2016)

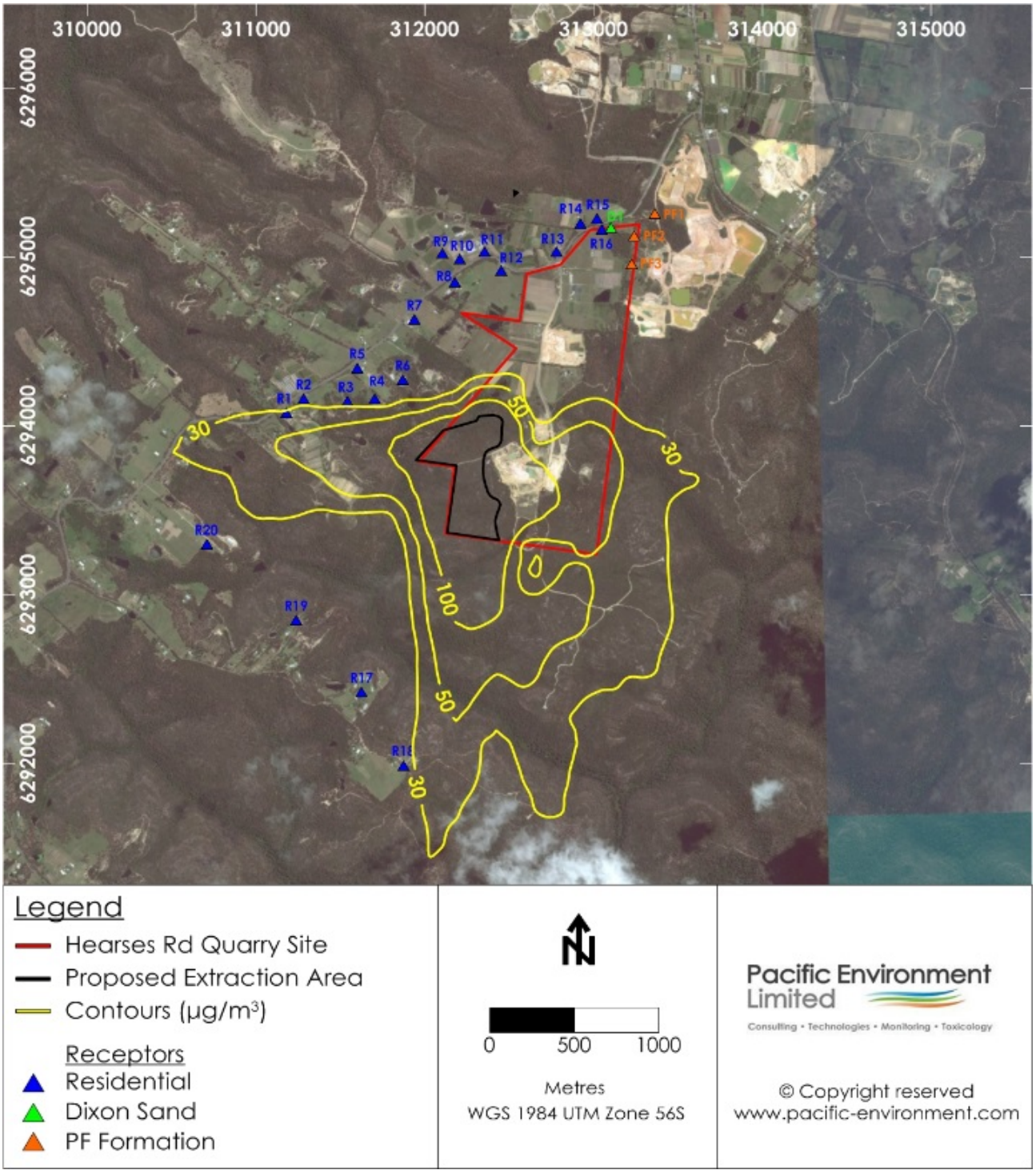

Figure 6.15 Worst Case Day Operations Maximum 24-Hour PM10 Concentration

Source: Figure 7.1 Dixon Sand Haerses Road Modification – Air Quality Assessment (Pacific Environment, 2016)

6.6.5 Mitigation and Management Measures

The following air quality management measures will continue to be implemented at the site as part of the Modification:

- use of a water cart to control emissions from haul roads (unsealed)
- enforcement of speed limits onsite
- progressive rehabilitation of exposed areas
- minimising drop height of material during truck loading and unloading where possible
- management of dust generating activities during unfavourable meteorological conditions.

6.7 Ecology

A detailed Biodiversity Assessment Report (BAR) has been prepared to assess the potential ecological impacts of the Modification using the Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (FBA). The FBA was released in October 2014 and specifies the required approach for ecological assessments for major projects in NSW. The FBA process is a credit driven system where calculators provided by the NSW government are input with ecological data about the site to generate 'impact credits'. The project is then required of offset these credits through a biodiversity offset strategy. The BAR report is provided in **Appendix 6** with a summary included in this section.

Following the FBA methodology, the BioBanking Credit Calculator (BBCC) Version 4.1 (Major Project Assessment Type) was applied following extensive literature reviews, the identification of relevant landscape features and detailed flora and fauna field surveys, in accordance with the BioBanking Assessment Methodology (BBAM) (DECC, 2008a).

6.7.1 Environmental Setting

The proposed extraction area lies in the Sydney Basin bioregion, at the top of the local catchment of Little Cattai Creek, and drains towards the west. The Modification area encompasses an area of approximately 44 hectares of which some small areas (approximately 4 ha) in the south have been disturbed by existing quarrying activities. The majority of the Modification area remains intact native woodland and forest vegetation. The woodland and forest areas of the Modification area is on the edge of a very large connected area of woodland and forest that extends eastwards towards the coast including Yengo National Park, Wollemi National Park and the Blue Mountains National Park in the west. This remnant of connected woodland and forest vegetation is among the largest remnants of woodland and forest along the east coast of NSW.

6.7.2 Avoidance Measures

Dixon Sand commissioned initial ecological field surveys within a broader biodiversity study area which included the Modification disturbance area and surrounding land to inform its design process for the Modification. Through this process, different quarry boundaries were considered and Dixon Sand sought to minimise the biodiversity impacts associated with the Modification whilst providing an economic resource. Key factors in selecting the final design of the Modification included the likely impacts on significant ecological features, including threatened species, threatened ecological communities (TEC) and/or their habitats.

Key ecological constraints that have been considered by Dixon Sand during the design phase of the Modification include the location and extent of the Coastal Upland Swamp(s) in the Sydney Basin Bioregion Endangered Ecological Community (EEC) (referred to as Coastal Upland Swamp TEC) and the population of threatened flora species *Darwinia biflora* that was identified in the Modification area.

Dixon Sand reduced the extent of the proposed extraction area from that initially proposed and thus minimised the impacts to *Darwinia biflora*. Additionally, only a very small portion of Coastal Upland Swamp TEC is now being impacted by the Modification. The final proposed extraction area boundary also includes a 50 metre buffer around the Coastal Upland Swamp TEC that will be retained.

6.7.3 Assessment Methodology

The threatened species and ecological communities known or likely to occur within the Modification area were identified by a systematic approach comprising appropriate database searches, a review of recent literature and targeted field surveys.

Database searches were undertaken to develop a list of TECs and threatened flora and fauna species that have previously been recorded, or are predicted to occur within 10 kilometres of the boundary of the Modification area. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species and endangered populations. Relevant databases included:

- EPBC Protected Matters Search Tool
- OEH Atlas of NSW Wildlife.

A preliminary assessment using the BioBanking Credit Calculator was undertaken to provide a list of species credit species that might require targeted survey and the suitable survey periods for each species. The results of the database searches, literature review and preliminary assessment using the BioBanking Credit Calculator were used to design the survey requirements for species credit species so that adequate surveys were undertaken.

The vegetation of the Modification area was surveyed over two periods. The first was during spring, from 25 to 27 November, 2014 and the second was in summer, from 14 to 17 December, 2015. The additional targeted species survey undertaken in December 2015 focussed primarily on threatened flora species.

Fauna surveys across the proposed extraction area were undertaken from 25 to 27 November 2014 as well as on 16 December 2015. Fauna survey methods included a range of survey techniques including targeted searches, hair funnel trapping, call playback, anabat echolocation, spotlighting, remote detection camera surveys and meandering transects. Further detail on survey methods are provided in **Appendix 6**.

Following completion of the field survey, the BioBanking Credit Calculator (BBCC) Version 4.1 (Major Project Assessment Type) was applied in accordance with FBA methodology (OEH 2014) to calculate the credit requirements for the Modification.

6.7.4 Key Values of the Modification Disturbance Area

6.7.4.1 Landscape Features

Landscape features that were considered in the connectivity value scores in the FBA assessment for the Modification area are outlined in **Table 6.19** below.

Table 6.19 Landscape Features in the Modification Area

Landscape Features	
IBRA Bioregion	Sydney Basin
IBRA Subregion	Yengo – Hawkesbury/Nepean
Mitchell Landscape	Hornsby Plateau
Rivers, Streams, Estuaries	1st order streams from Stone Chimney Arm Creek
Wetlands	None identified
Native Vegetation	82.19 hectares in the inner assessment circle 745.59 hectares in the outer assessment circle
State or Regional Biodiversity Links	None identified

No state or regional significant biodiversity links were identified within a plan approved by the Chief Executive of OEH in the Yengo – Hawkesbury/Nepean area. Although a number of first order streams of tributaries of Stone Chimney Arm Creek run through the site, these are not defined as state or regional significant biodiversity links under the FBA (OEH 2014).

6.7.4.2 Native Vegetation

Surveys of the Modification area identified four Biometric Vegetation Types (BVTs) (excluding exotic pastures) being:

- HN560 – Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion
- HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion
- HN582 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion
- HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion.

The BVTs were categorised into four vegetation condition zones (refer to **Figure 6.16**).

One TEC, listed under the TSC and EPBC Act, was recorded in the proposed extraction area (refer to **Figure 6.17**) being the Coastal Upland Swamp(s) in the Sydney Basin Bioregion Endangered Ecological Community (EEC). Coastal Upland Swamp in the Sydney Basin Bioregion is listed as an EEC under the TSC Act. The proposed extraction area supports 0.08 hectares of Coastal Upland Swamp(s) in the Sydney Basin Bioregion EEC within HN560 - Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion (Moderate/Good Condition). A larger area of this community occurs outside the Modification disturbance area, with the Modification being designed to avoid impact on this area.

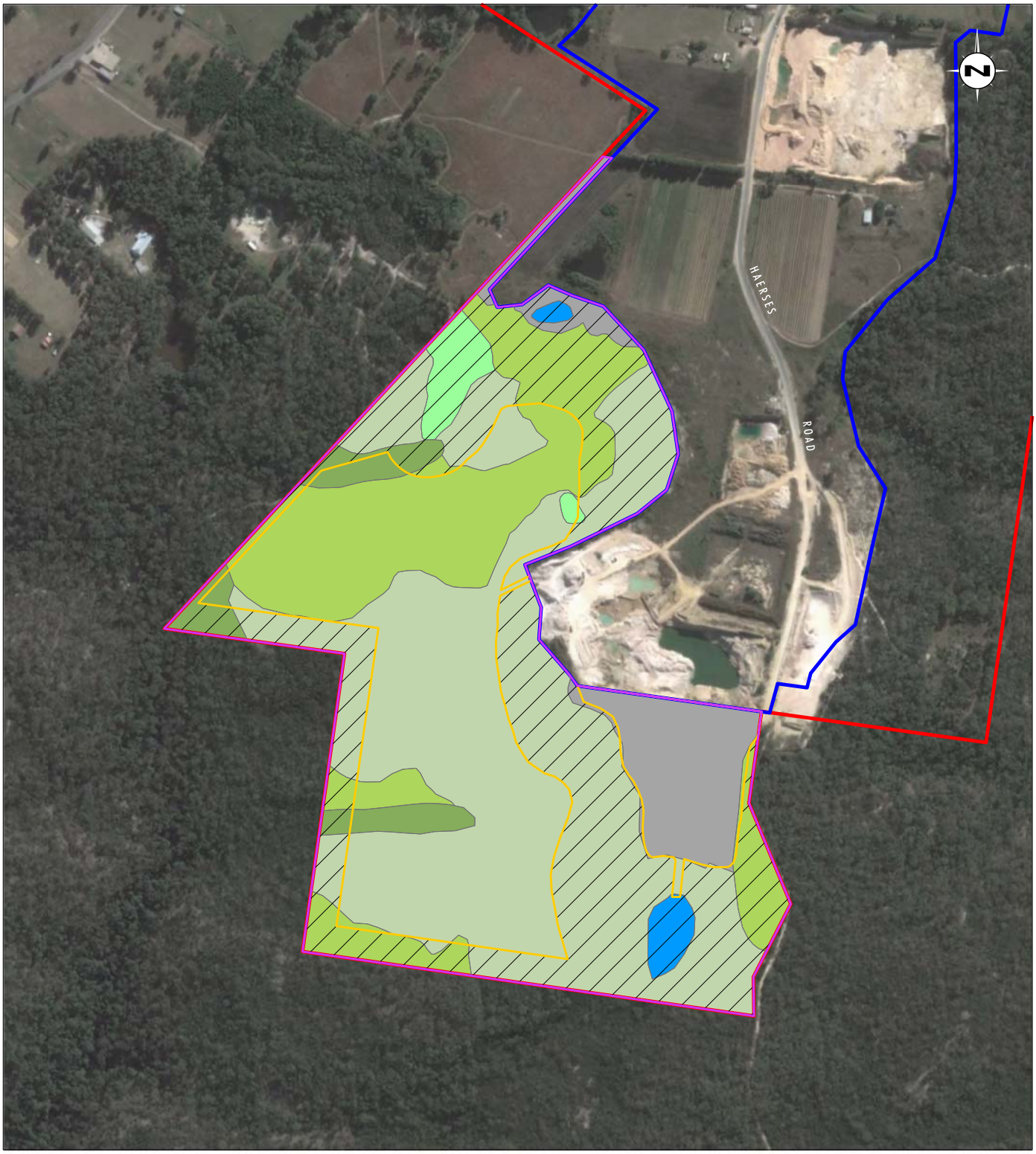

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Approved Extraction Area
- Modification Disturbance Area
- Ecology Study Area
- Zone 1: HN560 – Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion – Moderate to Good Condition
- Zone 2: HN566 – Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion – Moderate to Good Condition
- Zone 3: HN582 – Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion – Moderate to Good Condition
- Zone 4: HN586 – Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion – Moderate to Good Condition
- Cleared
- Dam
- Area Mapped Outside The Development Site (not impacted)

FIGURE 6.16

Biometric Vegetation Types

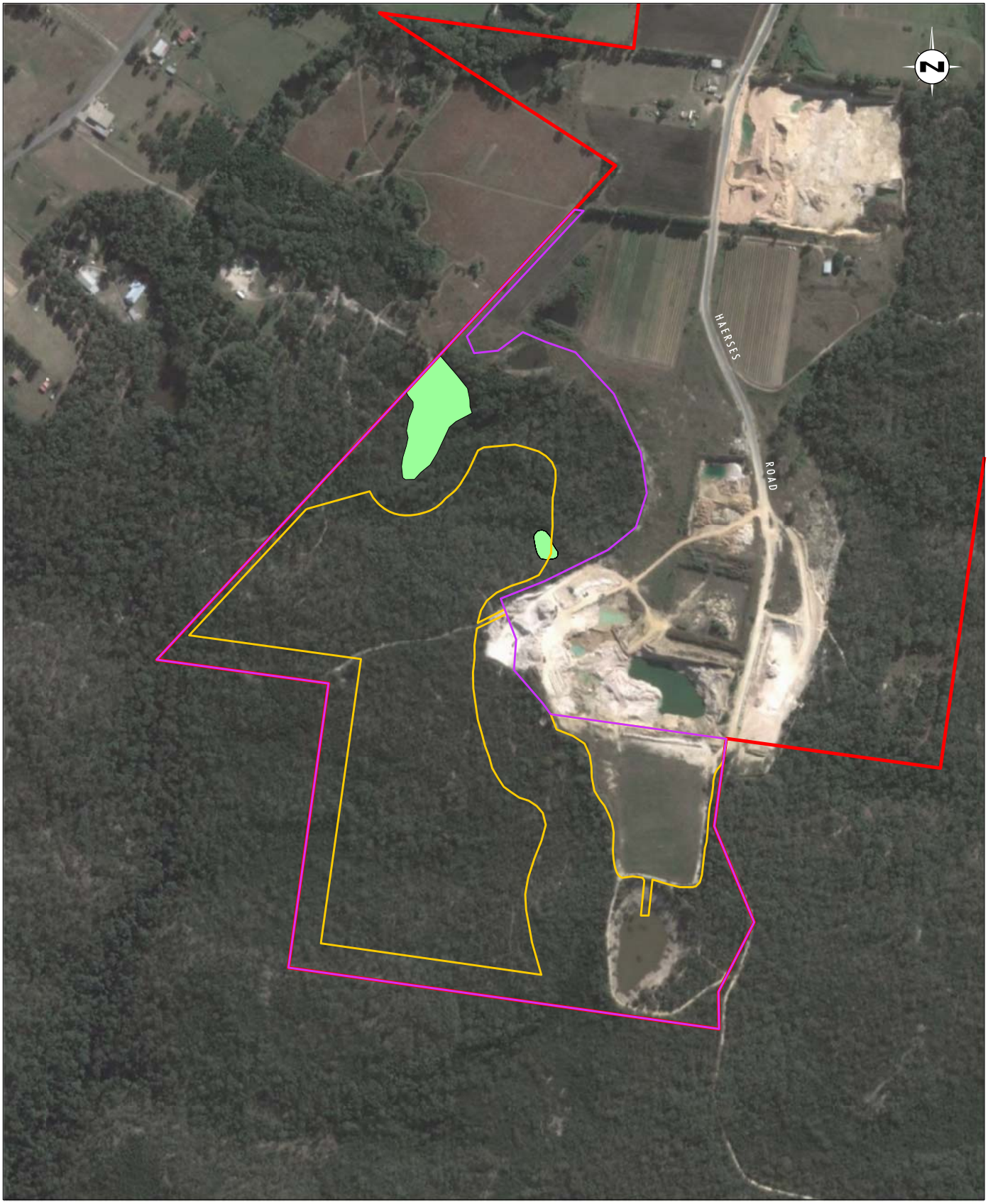

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

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Legend

- Haerses Road Quarry Site
- Modification Disturbance Area
- Ecology Study Area
- Zone 1: HN560 – Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion – Moderate to Good Condition (Coastal Upland Swamp(s) in the Sydney Basin Bioregion EEC under the TSC Act and EPBC Act)

FIGURE 6.17

Threatened Ecological Communities

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6.7.4.3 Threatened Flora Species

The FBA methodology categorises fauna species as either ecosystem-credit species or species-credit species. These are defined as:

- Ecosystem-credit species – species that can be reliably predicted to occur in Plant Community Types (PCTs) and have a high likelihood of occurring on the site. Therefore, targeted surveys for ecosystem-credit species are not required.

- Species-credit Species – species that cannot be reliably predicted based on a PCT, distribution or habitat criteria. These species require targeted survey effort to determine their presence or otherwise on the site.

All non-threatened species and some threatened species are ecosystem species and do not therefore require further detailed assessment under the methodology. The remaining threatened species are species-credit species and require further assessment and the calculation of impact species-credits under the FBA methodology.

Five species-credit species were recorded in the Modification disturbance area during the surveys undertaken for this assessment (refer to **Figure 6.18**). These were:

- *Darwinia biflora*

- *Grevillea parviflora* subsp. *supplicans*

- *Tetratheca glandulosa*

- Dural woodland snail (*Pommerhelix duralensis*)

- Eastern pygmy-possum (*Cercartetus nanus*).

Another species-credit species, *Hibbertia superans*, was also recorded during these surveys outside the Modification disturbance area. A discussion on these records is provided below and a full species list from the surveys is included in **Appendix 6**.

6.7.4.4 Threatened Fauna Species

One ecosystem credit species, large-eared pied bat (*Chalinolobus dwyeri*), was recorded in the proposed extraction area during the surveys undertaken. One other ecosystem credit species, little bentwing-bat (*Miniopterus australis*), was recorded within the ecology study area (refer to **Figure 6.19**).

A range of other threatened species were predicted to occur by the BioBanking Credit Calculator (Major Project Assessment Type). These are discussed in detail in **Appendix 6**.

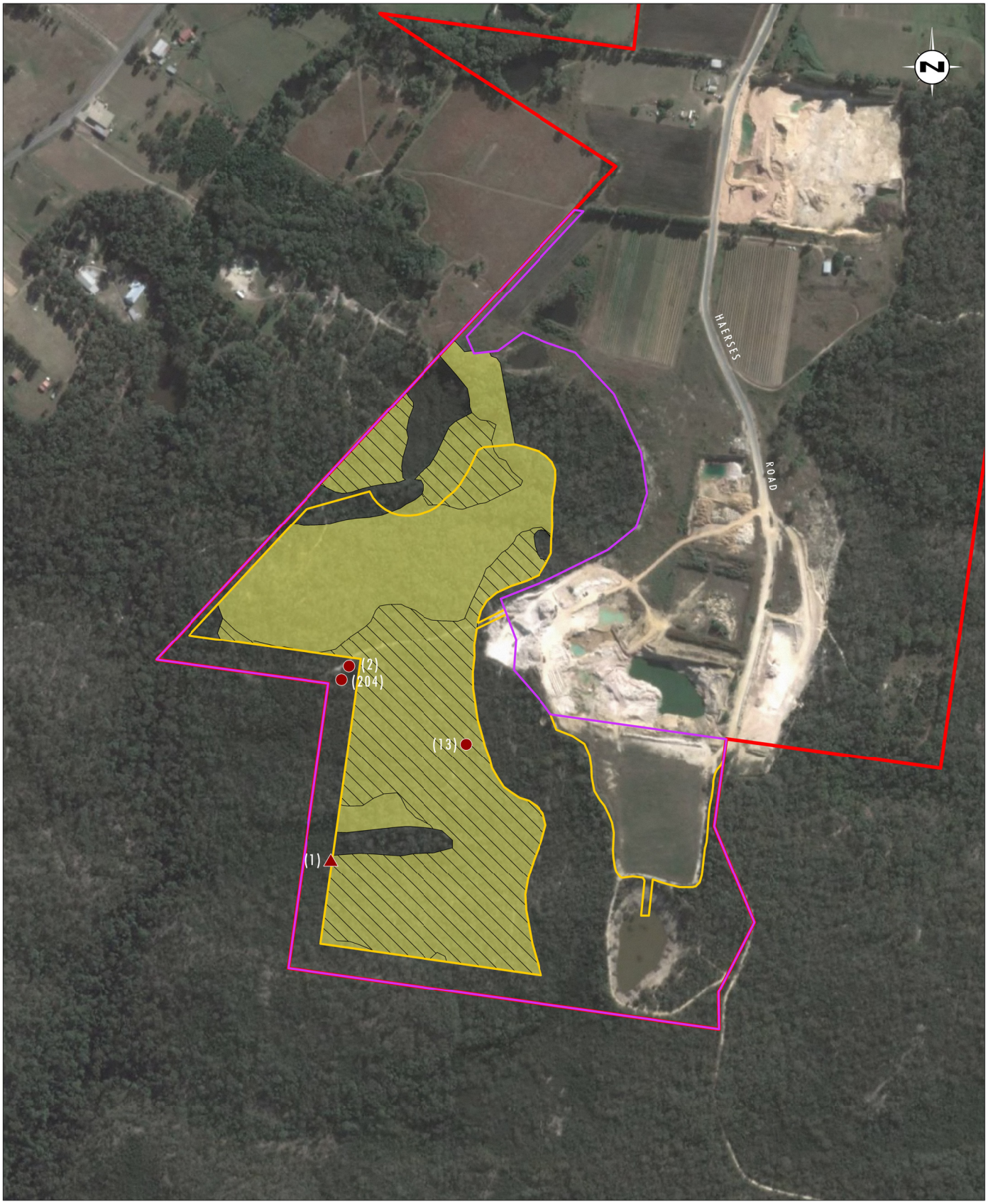

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 200 400m
1:7500

Legend

- Haerses Road Quarry Site
- Modification Disturbance Area
- Ecology Study Area
- Darwinia biflora, Tetratheca glandulosa and Dural woodland snail
- Eastern pygmy-possum
- *Grevillea parviflora* subsp. *supplicans*
- *Hibbertia superans*

FIGURE 6.18

Species-credit Species

File Name (A4): R05/3479_068.dgn
20160922 10.35

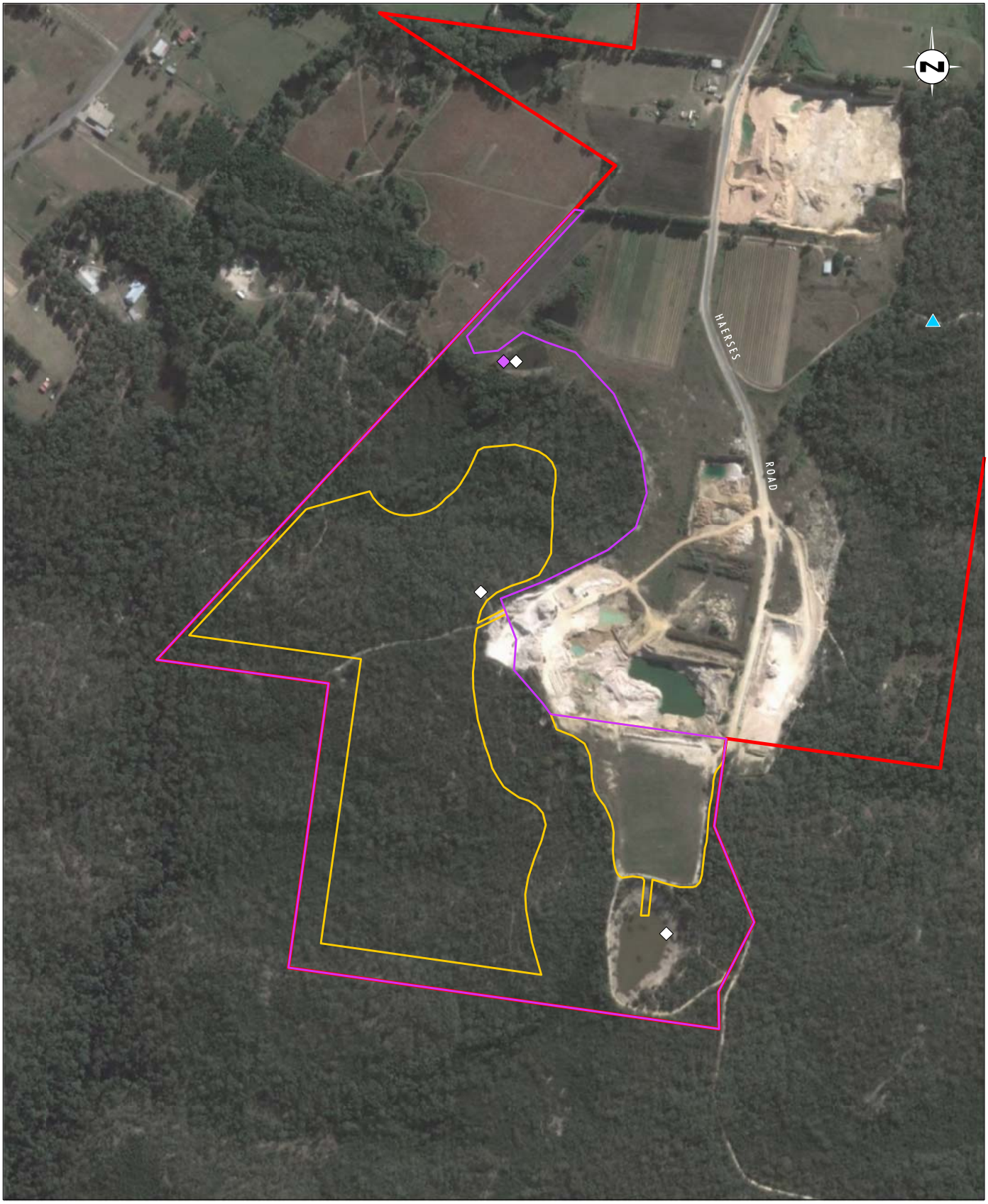

Image Source: Google Earth - DigitalGlobe (May 2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 100 200 400m
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Legend

- Haerses Road Quarry Site
- Modification Disturbance Area
- Ecology Study Area
- Glossy Black-cockatoo (2 recorded)
- Little Bentwing-Bat
- Large-Eared Pied-Bat

FIGURE 6.19

Ecosystem-credit Species

File Name (A4): R05/3479_066.dgn
20160922 10.38

6.7.5 Impact Assessment

6.7.5.1 Direct Impacts

The Modification will result in a range of direct impacts on biodiversity values within the Modification disturbance area. Direct impact includes loss of native vegetation and fauna habitats as a result of direct clearance works and construction of the quarry.

Table 6.20 below outlines these impacts as they were entered into the BioBanking Credit Calculator (Major Project Assessment Type). **Table 6.20** also outlines the ecosystem credits required to offset those impacts. A full Credit Calculator report is included in **Appendix 6**.

Table 6.20 Biometric Vegetation Types Requiring Offset and the Ecosystem Credits Required

Biometric Vegetation Types	Area to be Impacted (ha)	Ecosystem Credit Requirements
HN560 Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion (Moderate/Good)	0.08	3
HN566 Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion (Moderate/Good)	6.67	377
HN582 Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion (Moderate/Good)	11.15	538
HN586 Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion (Moderate/Good)	0.99	44

Table 6.21 below outlines the species-credit species to be impacted as a result of the Modification and the species credits required to offset those impacts. A full Credit Calculator report is included in **Appendix 7**.

Table 6.21 Species-credit Species Requiring Offset and the Species Credits Required

Common Name	Species Name	Species Credits Required
Darwinia biflora	*Darwinia biflora*	360
eastern pygmy-possum	*Cercartetus nanus*	223
Grevillea parviflora subsp. *Supplicans*	*Grevillea parviflora* subsp. *supplicans*	338
Dural woodland snail [1]	*Pommerhelix duralensis*	1,372
Tetratheca glandulosa	*Tetratheca glandulosa*	288

[1] This species was not able to be added to the list of threatened species within the BBCC. Instead Mitchells rainforest snail (*Thersites mitchellae*) was entered into the BBCC as it has the same Threatened Species Offset Multiplier as the dural woodland snail of 7.7.

In summary, the Modification requires 962 ecosystem credits and 2581 Species credits.

6.7.5.2 Indirect Impacts

The Modification is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the Modification.

Revision to the boundary of the proposed extraction area was made to provide a minimum 50 metre buffer around the Coastal Upland Swamp(s) EEC occurring outside the Modification disturbance area.

Construction and operational noise and dust impacts have the potential to adversely impact native species. Potential impacts include:

- dust covering vegetation thereby reducing vegetation health and growth
- noise disturbing the roosting and foraging behaviour of fauna species
- noise reducing the occupancy of areas of suitable habitat.

The design of the Modification will include inherent measures to minimise the potential for adverse noise and dust impacts. These include:

- the use of physical barriers adjacent to operational quarry areas, where practical, such as earthen bunds and noise walls
- dust suppression on haul roads and other operational areas to reduce vehicle generated dust emissions
- the minimisation of vegetation clearance to that required for operational purposes
- progressive rehabilitation and stabilisation of disturbed land
- equipment maintenance to minimise noise generation.

There is also the potential for weed species to be inadvertently brought into the site with imported materials, or to invade through removal of native vegetation. Mitigation measures will be implemented to minimise the potential for weed encroachment into native vegetation areas around the proposed extraction area (refer to **Appendix 6**).

6.7.6 Mitigation Measures

Dixon Sand has committed to the implementation of a comprehensive strategy to mitigate the impacts of the Modification on biodiversity during the operational and construction phases of the Modification. This includes specific measures to minimise the potential impacts on the biodiversity of the Modification area and the locality. General mitigation measures will include:

- ongoing weed management
- ongoing sediment and erosion controls
- a tree felling procedure will be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees

- employee education and training including inductions for staff, contractors and visitors to the site, to inform personnel of the biodiversity issues present at the site and their role and responsibilities in relation to the protection and/or minimisation of impacts to biodiversity

- areas of biodiversity value outside the proposed extraction area will be fenced or signposted, where appropriate, to prevent the unnecessary disturbance

- traffic control measures/speed limits/signage will be utilised on haul roads and access roads to minimise fauna injury/road kills.

Further details of the proposed management and mitigation measures are outlined in **Appendix 6**.

6.7.7 Biodiversity Offset Strategy

Dixon Sand is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Modification under the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014). Firstly, Dixon Sand has sought to design the Modification to avoid and minimise ecological impacts in the project planning stage and a range of impact mitigation strategies have been included in the Modification to mitigate the impact on biodiversity values.

Fulfilling offset requirements under the FBA will be undertaken using one or a combination of the following offset strategies:

- on-site in-perpetuity conservation of applicable credits

- offsetting through a site secured by a BioBanking Agreement

- potentially securing required credits through the open credit market, off site, if required

- if suitable offsets are unavailable, contributing money to supplementary measures in accordance with relevant conservation or recovery actions will be investigated.

It is currently proposed that the biodiversity offset strategy will consist of the following:

- establishment of proponent-managed offset sites, including the following sites (refer to **Figure 6.20**):

    - Haerses Road Offset Site

    - Porters Road Offset Site

- purchase of credits from the Biodiversity Credits Register for the residual credits that need to be retired.

Table 6.22 below provides a summary of the credits generated from the proponent-managed offset sites proposed by Dixon Sand.

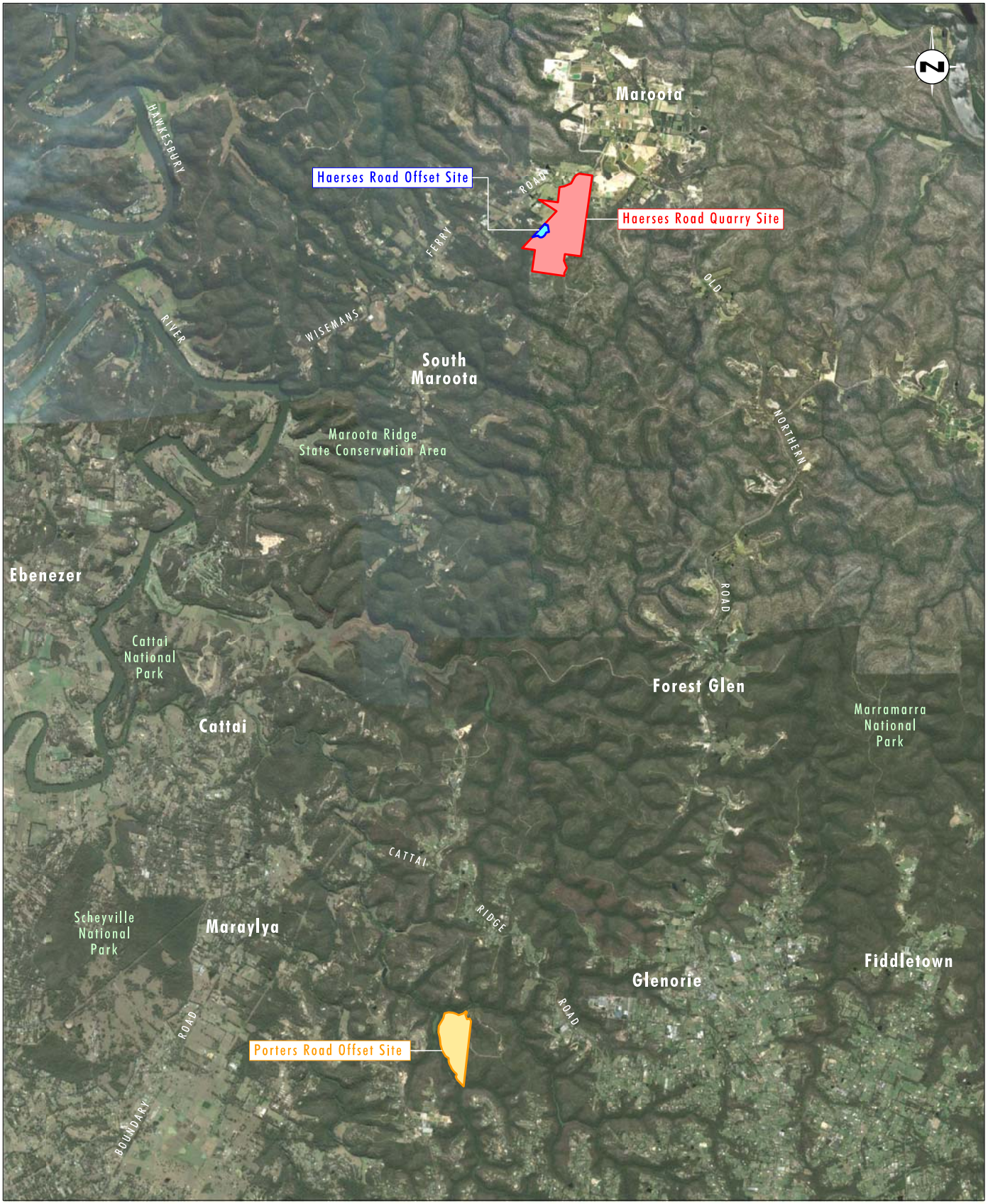

Image Source: Google Earth (2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Haerses Road Quarry Site
- Haerses Road Offset Site
- Porters Road Offset Site

FIGURE 6.20

Proposed Offset Sites

Table 6.22 Summary of Key Potential Offsetting Outcomes

Name	Credits Required	Haerses Road Offset Site Credits Generated	Porters Road Offset Site Estimated Credits	Overall Status
Ecosystem Credits				
HN560 Needlebush – Banksia Wet Heath on Sandstone Plateaux of the Sydney Basin Bioregion (Moderate/Good)	3	11	0	+8
HN566 Red Bloodwood – Scribbly Gum Heathy Woodland on Sandstone Plateaux of the Sydney Basin Bioregion (Moderate/Good)	377	6	86	-285
HN582 Scribbly Gum – Hairpin Banksia – Dwarf Apple Heathy Woodland on Hinterland Sandstone Plateaux of the Central Coast, Sydney Basin Bioregion (Moderate/Good)	538	17	104	-417
HN586 Smooth-barked Apple – Red Bloodwood – Sydney Peppermint Heathy Open Forest on Slopes of Dry Sandstone Gullies of Western and Southern Sydney, Sydney Basin Bioregion (Moderate/Good)	44	4	327	+287
Total	**962**	**38**	**517**	**-407**
Species Credits Required and Generated				
Darwinia biflora	360	14	142	-204
eastern pygmy-possum (*Cercartetus nanus*)	223	11	0	-212
Grevillea parviflora subsp. *supplicans*	338	0	0	-338
Dural woodland snail (*Pommerhelix duralensis*)[1]	1,372	16	0	-1,356
Tetratheca glandulosa	288	14	142	-132
Total	**2,581**	**55**	**284**	**-2,242**
Species Credits Generated				
Epacris purpurascens subsp. *purpurascens*	0	0	142	+142
Hibbertia superans	0	0	142	+142
Bynoe's Wattle (*Acacia bynoeana*)	0	0	142	+142
Lasiopetalum joyceae	0	0	64	+64

Dixon Sand will investigate, in consultation with OEH, the potential use of the Offsets Fund (when available) in addition to the proposed offset sites to address the residual credit requirements for the Modification.

With a number of ecosystem and species credits that remain in deficit after considering those generated at two offset sites and those that are available for purchase on the Biodiversity Credits Register, Dixon Sand has listed credits sought after on the Credits Wanted Register.

6.8 Traffic and Transport

A Traffic Impact Assessment has been prepared for the Modification by SECAsolution and is summarised in this section of the EA. The full report is presented in **Appendix 4**.

6.8.1 Existing Traffic and Access Arrangements

The main road through the locality is Old Northern Road, which runs in a north south direction to the west of Haerses Road Quarry. It provides an important road link through the locality, providing a connection for a number of rural suburbs between Wisemans Ferry to the north and Baulkham Hills and the greater area of Sydney to the south. Wisemans Ferry Road connects with Old Northern Road to the east of the quarry. Wisemans Ferry Road provides a sealed width in the order of 6m operating under a speed limit of 80 km/h and provides a route through to Cattai and the north-west sector of Sydney.

Haerses Road Quarry is located on Haerses Road, off Wisemans Ferry Road, to the west of the intersection with Old Northern Road. Vehicle access to the quarry is via Haerses Road. The intersection of Haerses Road and Wisemans Ferry Road was upgraded as required by the consent conditions for the quarry. There are four dwelling houses owned by Dixon Sand located off Haerses Road. One house is currently used as the Haerses Road Quarry site office with the three other houses rented.

The current approval allows for 28 inbound truck movements and 28 outbound truck movements per day. The inbound truck movements must be right hand turns from Wisemans Ferry Road with up to 10 movements permitted between 6am and 7am. The outbound truck movements can consist of up to 7 left hand turns onto Wisemans Ferry Road heading direct to market and between 21 and 28 right hand turns onto Wisemans Ferry Road heading to the Old Northern Road Quarry for processing. Truck movements to the Old Northern Road Quarry pass through the township of Maroota and Maroota Public School.

Car parking within the quarry currently consists of informal parking on the lawn associated with the site office (former dwelling house) opposite Stage 1 of the approved operations.

6.8.2 Proposed Traffic and Access Arrangements

The site access to Haerses Road Quarry will remain unchanged. There will also be no change to the total number of truck movements which will remain as 28 inbound movements and 28 outbound movements. To allow the flexibility to transport up to 250,000 tpa of product direct to market, it is proposed to allow the 28 outbound truck movements to be either left or right hand turns depending on the market destination. It is anticipated that truck movements from the quarry onto Wisemans Ferry Road would be approximately 50% left hand turns and 50% right hand turns. It is also proposed to allow inbound truck movements to be either left hand or right hand turns from Wisemans Ferry Road depending on the origin of trucks returning to the quarry to pick up a load.

The Modification also seeks to allow the import of VENM and ENM to Haerses Road Quarry for processing and then sale. The laden inbound truck movements transporting VENM or ENM to site would replace a normally empty inbound truck movement and would count against the total allowable 28 inbound truck movements. Similarly, outbound movements of the reprocessed material would count against the

allowable 28 outbound truck movements. As such, no additional truck movements would be required for the processing and sale of VENM and ENM.

Currently the amount of material leaving the Haerses Road site is calculated via weight scales fitted to the front end loader when loading trucks. With the potential increase from 60,000 tpa to 250,000 tpa exported directly to market a more efficient method is required. A weighbridge is therefore proposed to be constructed at the northern end of Haerses Road adjacent to the workshop and site office (refer **Figure 1.3**).

6.8.3 Impacts of the Proposed Changes

The Modification would not change the total traffic movements for the quarry. The ability to transport a greater proportion of product, potentially all product, direct to market would result in a decrease in truck numbers on Old Northern Road passing Maroota Public School and the township of Maroota.

The key intersections potentially affected by the Modification are the T intersection of Haerses Road with Wisemans Ferry Road and Wisemans Ferry Road with Old Northern Road. Observations on site show that both of these intersections operate very well with no delays for the majority of traffic movements. Traffic turning into or out of the side road typically did not need to stop and the only delay was that associated with manoeuvring through the intersection.

A Sidra intersection analysis has been completed at the intersection of Old Northern Road and Wisemans Ferry Road and the analysis confirms that the intersection operates very well with negligible delays and congestion. All movements have Level of Service A and the delays are less than 7 seconds for all movements. It is considered that the intersection of Haerses Road and Wisemans Ferry Road would operate to a similar level of service and delays. With no increase to the truck numbers at this location the intersection will continue to operate at this level of service.

There would be no change to access to Haerses Road Quarry and hence the Traffic Impact Assessment found that there is no requirement for road or upgrade works to the Haerses Road and Wisemans Ferry Road intersection.

There are no bus stops, public transport routes, cycling or pedestrian facilities that would be impacted by the Modification.

The Haerses Road operation hours would not change as a result of the Modification.

6.9 Visual Amenity

6.9.1 Existing Visual Environment

Haerses Road Quarry is located on a north-south aligned ridge. The viewing catchment of the site is generally bounded by Wisemans Ferry Road which follows the ridge line to the north and south west of the site and Old Northern Road which follows the ridgeline to the east. To the south of the site is an extensive area of unoccupied bushland. Stages 1 and 2 (refer to **Figure 1.4**) of the approved quarry stages are currently in operation at the site.

There are potential public viewing points to the site from various points in the surrounding landscape including:

- some residences to the north east, east and north west on Wisemans Ferry Road and Hitchcock Road have middle distance views of the site

- motorists on Wisemans Ferry Road have intermittent views of the site between existing dwellings and roadside vegetation.

The approved quarry operations are closer and more visible from the majority of potential viewing locations compared to the elements of the Modification that would be visible. As part of the existing consent Dixon Sand is required to plant screen trees along the northern boundary of the site.

6.9.2 Visual Assessment

The aspects of the Modification that have the potential to alter existing visual amenity of the quarry are the additional extraction area, the plant at the processing area and the weigh bridge, parking area and maintenance shed at the northern end of the site.

Based on topography only (i.e. no allowance for screening vegetation) an assessment of the visual catchment indicates that the additional extraction area would be visible for a small number of residences to the west of the site located on the southern side of Wisemans Ferry Road. Taking into account screening vegetation it is likely that only those residences with an existing view of Stage 5 would also have views, or partial views, of the additional extraction area. As the additional extraction area is down slope of the currently operational Stage 5 this would generally appear as a continuation of the existing operational area with very similar visual characteristics. It would, however, be closer to these residences being approximately 440 metres distant at the closest point compared to the existing 660 metres for the approved quarry. Seven metre high noise bunds will be constructed on the western side of Cell 4 and Cell 5 of the additional extraction area, however due to the 30 metre increase in height from the western to the eastern side of the extraction area, these bunds will not fully screen the extraction pit. No dwellings to the east of the site would view the additional extraction area due to its topographical position.

Similarly, based on topography only (i.e. no allowance for screening vegetation) there is the potential that some residences to the east of the site may have views to the proposed processing area. This would represent a fairly minor change to the existing situation where the mobile screening plant may be located within any part of the active stages of the approved operations. The Modification would result in additional plant on site being the wet processing plant and crushers which will be located in the processing area. Views to this equipment would generally be shielded by stockpiled quarry material. Furthermore, it is likely that intervening vegetation will screen the majority of these potential views.

The proposed maintenance shed, parking area and weighbridge will be located in the northern part of the site to the south of the existing dwelling, on the eastern side of Haerses Road (refer **Figure 6.20**). The existing dwelling will be converted to become the site office and would not result in any change in visual character. The maintenance shed would be 20 metres by 24 metres with a peaked roof at approximately 8 metres high, with an awning on one side and constructed of Colourbond material in a green or brown colour. This structure would be similar in appearance to numerous other existing sheds in the local area and is not considered likely to adversely affect the existing visual character.

The weighbridge and car parking area (12 spaces) would be adjacent to Haerses Road and be of minor visual impact and will not be visually inconsistent with the existing built elements in this area.

In summary, the visual characteristics of the Haerses Road Quarry site would change very little as a result of the Modification, with the changes being consistent with the existing visual environment of both the quarry and the surrounding areas.

6.10 Aboriginal Cultural Heritage

An Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) has been undertaken for the Modification in compliance with the Department of Environment, Climate Change and Water (DECCW, now Office of Environment and Heritage (OEH)) *Aboriginal Cultural Heritage Consultation Requirements (ACHCRs) for Proponents* (2010). The ACHAA is presented in **Appendix 7** with a summary of the key findings included in this section.

6.10.1 Consultation Process

Following the notification process, the organisations that registered an interest in consultation for the Modification were:

- Deerubbin Local Aboriginal Land Council (DLALC)
- Darug Land Observations (DLO)
- Tocomwall
- Kawul Cultural Services
- Darug Aboriginal Cultural Heritage Assessments (DACHA).

A Native Title Search from the National Native Title Tribunal indicated that there were no registered Native Title applications in the search area, which covered the Haerses Road Quarry site.

Registered Aboriginal Parties were encouraged to provide comments on the Aboriginal cultural values and significance of the Modification disturbance area and on a draft of the ACHAA for inclusion in this final ACHAA. A full consultation log and consultation records are provided in **Appendix 7**.

6.10.2 Aboriginal Social, Cultural and Archaeological Context

Haerses Road Quarry is located in the traditional lands of the Darug people who were known to have laws that promoted sustainable hunting and gathering that ensured that all members of the clan were fed (Kohen 1993). Men would hunt possums, goannas and wallabies whereas the women would fish and also gather tubers, fruits and other sources of food (Turbin 1989). The Darug people were also known to use the ridgelines and creeklines to travel across their lands due to the predominantly steep and rugged terrain and based on economic behaviour it is likely that inland Aboriginal groups had little contact with those located on the coast. Early observations by soldiers noted that there were differences in tribal groups in addition to economic and social divisions (McDonald 2008).

A search of the OEH Aboriginal Heritage Information Management System (AHIMS) was undertaken on 5 January 2016 which identified 64 Aboriginal sites within 10 kilometres of the Haerses Road Quarry. Of these sites, five are located within two kilometres of the quarry and one is located 650 metres to the east of the quarry. These sites are predominantly grinding grooves and engraving sites with very few artefacts recorded in the area. Previous investigations have indicated that artefact scatters are likely to be present in low densities on ridgeways and travelways.

6.10.3 Survey Methodology

The survey of the extraction area was undertaken on 8 December 2015 by a field team of two Umwelt archaeologists and four Aboriginal party representatives from: Darug Land Observations; Deerubbin Local Aboriginal Land Council; Kawul Culture Services; and Tocomwall.

Based on the outcomes of the predictive archaeological model for the site, the survey strategy covered 100% of the spur crests and creek lines in addition to an adequate sample of the spur slopes. A small track was identified during the survey and this was followed as it was assessed to be the most likely area to have exposures that may have visible artefacts. Survey transects were 50-100 metres wide and conducted with the assistance of Aboriginal party participants with one archaeologist forming the centreline.

The survey methodology used complies with the requirements of OEH's *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) and Aboriginal participants had the opportunity during the survey to discuss any potential impacts of the Modification on Aboriginal cultural heritage sites and values.

6.10.4 Results

No Aboriginal artefacts were identified during the survey of the Modification disturbance area. Outcrops of sandstone were observed on the slopes within the proposed extraction area and were inspected for grinding grooves, engravings and other evidence of Aboriginal people using the landscape. The sandstone was highly weathered and no remains of Aboriginal use were identified.

The soil was observed to be sandy and skeletal. No areas of Potential Archaeological Deposit (PAD) were identified during the survey. The proposed extraction area is considered to have low archaeological potential based on a number of factors including: the landforms are not suitable for camping, soils are skeletal and unlikely to retain archaeological deposit; and water sources in the immediate vicinity of the proposed extraction area are ephemeral at best and would not support prolonged occupation. On this basis it is assessed that while Aboriginal people may have used the proposed extraction area and the site more broadly in a transitional fashion, this is unlikely to have resulted in the formation of archaeological deposits.

6.10.5 Archaeological Significance

The criteria applied to the assessment of archaeological significance are listed in **Appendix 7**. As no Aboriginal sites were identified in the survey area, the assessment of archaeological significance is applied to the landscape within the survey area as per **Table 6.23**.

Table 6.23 Assessment of Archaeological Significance

Landform within the survey area	Rarity Value	Representative Value	Research Potential	Educational Potential	Integrity	Overall Archaeological Significance
Creek Line	Low	Low	Low	Low	Low	Low
Spur Crest	Low	Low	Low	Low	Low	Low
Slope	Low	Low	Low	Low	Low	Low

6.10.6 Aboriginal Cultural Significance of the Landscape

As Aboriginal cultural significance relates to the values of a site, place or landscape to Aboriginal people, it must be determined by Aboriginal people. The registered Aboriginal parties participating in the assessment therefore have the right and obligation for assessing the significance of their cultural heritage. In assessing this significance a range of factors may be considered and this can extend beyond the physical presence of a site and its contents. Archaeological material, cultural knowledge, natural resources and landscape may all be considered.

Aboriginal parties on site during the survey noted that the area was rich with Aboriginal resources and the poor visibility limited the observation of any surface artefacts.

6.10.7 Management Measures

The recommendations presented below were discussed with the registered Aboriginal party representatives participating in the survey of the site. The registered Aboriginal party representatives indicated that the recommendations were suitable provided that there was clarity about the nature and extent of works and that consideration was given to any future works.

The following recommendations have been developed from information detailed in the ACHAA and current cultural heritage legislation:

- Dixon Sand should ensure that its employees and contractors are aware that it is an offence under Section 86 of *the National Parks and wildlife Act 1974* (NPW Act) to harm or desecrate an Aboriginal object unless that harm or desecration is the subject of an Aboriginal Heritage Impact Permit (AHIP) or other approval

- the Modification area does not contain any identified Aboriginal archaeological sites and therefore there is currently no requirement to obtain specific approvals relating to Aboriginal cultural heritage. However, in the unlikely event that previously unrecorded artefactual material is exposed during ground disturbance works, work must cease in the vicinity of the artefactual material and the registered Aboriginal parties contacted and the artefactual material managed in accordance with a methodology to be prepared in consultation with the registered Aboriginal parties and OEH, if required

- in the unlikely event that suspected human skeletal material is identified within the Modification disturbance area, all works in the immediate vicinity of the suspected human skeletal material will cease and the skeletal material will be inspected to determine if it is human (including assessment by a forensic specialist if required). If the skeletal material is human, the NSW Police and OEH will be contacted. No excavation will proceed until an appropriate course of action has been determined in consultation with NSW Police, OEH and the Aboriginal parties.

6.11 Historic Heritage

No listed heritage items were identified within the Haerses Road Quarry site or the immediate surrounds in the original 2005 EIS. A review of relevant heritage databases was undertaken for the Modification in July 2016, including:

- NSW State Heritage Register (SHR)

- State Heritage Inventory

- Australian Heritage Database (including Commonwealth and National Heritage lists and the Register of the National Estate (RNE))

- The Hills Local Environment Plan (LEP) 2012.

There were no known statutory heritage listings or potential archaeological sites within or in the immediate vicinity of the quarry. The archaeological site survey discussed in Section 6.10 did not identify any potential historic heritage sites.

No impacts on historic heritage are predicted as a result of the Modification.

6.12 Socio – economic

The consideration of socio-economic issues is a critical component of the NSW environmental assessment process, considering the potential impacts (both positive and negative) on the community both in terms of environmental impacts (e.g. dust, noise, visual as assessed in preceeding sections) and other social impacts, in addition to the consideration of economic benefits.

As part of the assessing socio-economic impacts, an understanding is required of the local community. **Section 6.12.1** provides a summary of key demographic data related to residents of Maroota as sourced from the 2011 ABS Census, while **Section 6.12.2** provides an overview of the issues raised by the community through the consultation process undertaken for the Modification.

6.12.1 Demographic and Economic Profile of Maroota

Analysis of key demographic data from the 2011 Census found that:

- The population of Maroota was 291, with a median age of 40.

- The average number of children per family was 1.9, and 47.3% of families in Maroota were couple families with children.

- Residents of Maroota have slightly higher levels of post-secondary education than the state average (40% compared to 37% for NSW).

- Volunteering levels were comparable to the state average (16.5% compared to 16.9% for NSW), and cultural diversity was lower than the state average with only 13.3% born overseas (31.4% for NSW).

- Mobility levels (as evidenced through usual place of residence five years ago) were lower than the NSW average (21.8% compared to 39.2%), suggesting a limited population movement in the area (ABS, 2011).

Analysis of key economic data from the 2011 Census found that:

- The largest industry of employment was mushroom and vegetable growing (7.1%), and the most common occupation was in management (21.3%).

- The unemployment rate is considerably lower than the NSW average at 3.4% (compared to 5.9% for NSW).

- The median weekly household income was $1,487, which is higher than the state average of $1,237.

- In terms of home ownership, 32.7% owned their house outright, and 36.7% held a mortgage. The median mortgage repayment was $1,600 and the median rent was $250 (ABS, 2011).

6.12.2 Community Issues Analysis

Residents were offered the opportunity to voice concerns or seek information related to the Modification through a newsletter that was provided to 130 households within proximity to Haerses Road Quarry and to the Maroota Public School. The newsletter provided information about the Modification, with email and telephone details provided for a representative from Dixon Sand. One resident responded to the newsletter by email, and voiced concerns about increased traffic and health concerns related to dust, as the resident's family members have asthma. This resident requested further information related to these matters, including:

- current and projected traffic and traffic routes associated with the modification, particularly related to trucks
- strategies to minimise the use of compression braking, such as signage
- dust mitigation strategies, which were of particular concern as the modified extraction area would be close to the resident's property
- an update regarding the status of the modification, and request for electronic copies of the EA and other relevant documents.

A Dixon Sand representative has spoken with the respondent to organise a time to meet to discuss the Modification and the identified issues of concern. Dixon Sand have made several follow up attempts to organise a suitable time to meet, however, at the time of preparing this report the meeting has not yet taken place.

A Community Consultative Committee for the Dixon Sand's quarry operations exists, and has 14 members comprised of Government representatives and local community resident and groups, including a representative from Maroota Public School. A review of the last two years of CCC minutes was undertaken finding that there were limited issues raised related to the quarry operations, and none related to the Haerses Road Quarry site. The CCC will continue to be a forum for residents to provide feedback about operations.

6.12.3 Assessment

In terms of the impact of the Modification to residents and local community, it is unlikely that the broader community will be greatly impacted by the Modification above and beyond current levels, given that change to current operations is not likely to greatly change the offsite impacts of the quarry operations from that which is currently approved. In addition, the change of traffic flow from Haerses Road Quarry with an increase in the number of trucks heading direct to market, will result in a reduction in trucks from Haerses Road Quarry travelling through the township of Maroota and past Maroota Public School.

In terms of the specific economic impact of the Modification, four staff are currently employed at the operations and there are plans to increase to eight staff, pending approval of the Modification. The additional employment of four full time staff at the Haerses Road Quarry has the potential to have a minor positive impact for local businesses through incidental spending in the local area.

The broader economic impact of the Modification will be the provision of high quality sand materials for the Sydney and regional markets which will largely be used in the construction of new homes.

The issues of concern raised through the consultation process, and other potential local amenity issues, have been assessed in detail in the noise, air quality and traffic sections of this report. Management and mitigation measures identified for these issues will assist to realise the benefits of the quarry while minimising these impacts on the local community.

6.13 Greenhouse Gas and Energy Assessment

This section presents the results of a greenhouse gas and energy assessment (GHGEA) for the Modification. From a greenhouse gas and energy perspective, the Modification will increase on-site energy consumption, shift the distribution of Scope 3 greenhouse gas emissions and increase total greenhouse gas emissions over the life of the quarry.

6.13.1 Methodology

The GHGEA framework is based on the methodologies and emission factors contained in the *National Greenhouse Accounts (NGA) Factors 2015* (DOE, 2015). The assessment framework also incorporates the principles of *The Greenhouse Gas Protocol 2004* (WRI/WBCSD, 2004) (The GHG Protocol).

The GHG Protocol provides an internationally accepted approach to greenhouse gas accounting. It provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality. The GHG Protocol defines three 'Scopes' of emissions for greenhouse gas accounting and reporting purposes. These scopes are briefly outlined below.

Scope 1 emissions are direct emissions which occur from sources owned or controlled by the proponent, over which they have a high level of control (such as fuel use).

Scope 2 emissions are those generated from purchased electricity consumed by the proponent, which can be easily measured and can be influenced through energy efficiency measures. Scope 2 emissions physically occur at the facility where electricity is generated (i.e. the power station).

Scope 3 emissions are indirect emissions that are a consequence of the activities of the proponent, but occur at sources owned or controlled by another reporting entity (e.g. outsourced services). Scope 3 emissions can include emissions generated upstream of the facility by providers of energy, materials and transport. Scope 3 emissions can also include emissions generated downstream of the facility by providers of product transport.

All emissions were calculated based on the methodologies and emission factors provided by the National Greenhouse Accounts (NGA) Factors 2015 (DOE, 2015).

6.13.2 Assessment Boundaries and Assumptions

The following GHGEA is limited to quantifying the greenhouse gas emissions associated with on-site energy use. The assessment does not quantify the greenhouse gas emissions associated with product use, product transport or land use change (clearing vegetation, developing biodiversity offsets and revegetation). As the Modification will not result in any changes to total annual production, no significant changes in annual greenhouse gas emissions associated with product transport are envisaged.

The greenhouse gas and energy use assessment is based on the following assumptions:

- electricity use will increase 25%, from 36 GJ to 45 GJ due to the operation of a new weighbridge and upgraded site facilities

- diesel use associated with quarrying materials will not change, and average 100 kL (3,860 GJ) per annum over the life of the quarry
- product material will be processed on-site using mobile plant, instead of being processed at the Old Northern Road Quarry
- the on-site processing plant will consume up to 157 kL (6,060 GJ) of diesel per annum
- the Modification will allow additional annual energy consumption between 2017 and 2031
- the Modification will allow the quarry to operate for an additional fifteen years.

6.13.3 Energy Consumption

Annual Energy Consumption

Table 6.24 includes a summary of the direct annual energy use impacts of the Modification. **Table 6.24** demonstrates that the Modification may increase the annual demand for energy by approximately 6,000 GJ.

Table 6.24 The impact of the Modification on annual energy consumption

Activity	Approved Project (GJ)	Modification (GJ)	Energy Use Change (GJ)
Electricity use	36	45	9
Diesel use – quarrying	3,860	3,860	0
Diesel use – processing	0	6,060	6,060
Total			**6,069**

Total Energy Consumption

The Modification allows total energy consumption to increase over the life of the quarry, through the addition of new processing equipment, and extending operations by fifteen years. **Table 6.25** demonstrates that the Modification may increase demand for energy by approximately 241,000 GJ.

Table 6.25 The impact of the Modification on total energy consumption

	Electricity use (GJ)	Diesel use (GJ)	Total (GJ)
Annual increase over the Approved Project 2017-2030	135	90,903	91,038
Additional 5 years of operation	675	148,803	149,478
Total	**810**	**239,706**	**240,516**

6.13.4 Greenhouse Gas Emissions

The Modification will allow the generation of both direct and indirect greenhouse gas emissions. **Table 6.26** summarises the additional greenhouse gas emissions that may be associated with the Modification.

Table 6.26 The impact of the Modification on total greenhouse gas emissions

Scope	Fuel use	Energy Use (GJ)	Emission Factor[1] (Kg CO2-e / GJ)	GHG Emissions (t CO2-e)
1	Diesel use	239,706	70.2	16,827
2	Electricity use	810	233	189
3	Indirect emissions associated with purchased diesel	239,706	3.6	863
3	Indirect emissions associated with purchased electricity	810	34	28
Total				**17,907**

6.13.5 Impact Assessment

The greenhouse gas emissions generated by the Modification have the potential to impact the environment and the greenhouse gas reduction objectives of national and international governing bodies.

Table 6.26 demonstrates that the Modification may allow up to 17,000 t CO_2-e Scope 1 emissions over the life of the quarry. **Table 6.26** also demonstrates that the energy use associated with the Modification will generate up to 200 t CO_2-e of Scope 2 emissions and approximately 900 t CO_2-e of Scope 3 emissions associated with purchased diesel and electricity. All Scope 2 and 3 emissions are attributable to, and may be reported by, third party entities not directly related to the Modification.

Over the life of the quarry, the annual Scope 1 emissions attributable to the Modification may average 570 t CO2-e per annum. Given the scale of the Scope 1 emissions, the Modification is unlikely to make a significant impact on atmospheric concentrations of greenhouse gas emissions or on Australia's ability to meet its emission targets.

6.13.6 Assessment of Mitigation Measures

Approximately 99 per cent of the Modification's Scope 1 and 2 emissions relate to on-site diesel use. Improving the diesel use efficiency associated with plant and equipment will provide the greatest reduction in greenhouse gas emissions. Dixon Sand will review opportunities for diesel use efficiency when purchasing or replacing equipment at the quarry and will appropriate maintain all equipment to provide for efficient operations.

[1] National Greenhouse Accounts factors. Department of the Environment 2015.

6.14 Quarry Rehabilitation

Dixon Sand is committed to the effective rehabilitation and closure of its quarry sites. This is achieved through progressive rehabilitation and managing quarry operations to work towards the eventual final rehabilitation and closure of the site.

In accordance with Condition 22 of Schedule 3 of the Consent, a Rehabilitation and Landscape Management Plan has been prepared for the approved project. This plan provides a detailed description of the planned approach to rehabilitation of the Quarry, including the rehabilitation of the quarry pit. The key aspects of the Modification which have the potential to revise the rehabilitation strategy outlined in the Rehabilitation and Landscape Management Plan are the additional extraction area and the site office and maintenance shed location. No changes are proposed to rehabilitation completion criteria or final land use, except that the additional quarry area will be returned to native vegetation.

The Rehabilitation and Landscape Management Plan prepared for the Quarry and approved by DPE provides a detailed description of the strategies that will be used to rehabilitate the areas disturbed by quarrying operations. The Plan will be updated for the Modification to incorporate the rehabilitation of the proposed extraction area.

Dixon Sand proposes to progressively rehabilitate the additional extraction area by refilling and contouring the extraction area by emplacement of fines from the wash plant combined with unsuitable material from the quarrying process and VENM and ENM to achieve a landform generally consistent with the surrounding topography and pre-quarrying landform.

As part of the detailed quarry planning process, a detailed Quarry Closure Plan will be developed approximately three years prior to cessation of quarrying activities. The Quarry Closure Plan will describe in detail the proposed operational and progressive rehabilitation procedures for the remainder of the quarry life and subsequent to the quarry closure.

6.14.1 Closure and Rehabilitation Objectives

Rehabilitation of the quarry extraction area will be undertaken in accordance with the relevant key principles of the Strategic Framework for Mine Closure (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia 2000) and encompasses the following objectives:

- provide a safe and stable landform compatible with the intended final land use
- comply with relevant regulatory requirements
- reduce the need for long term monitoring and maintenance by achieving effective rehabilitation
- complete the closure, decommissioning and rehabilitation works as quickly and cost effectively as possible whilst achieving primary objectives
- provide a sustainable plant cover through rehabilitation of disturbed areas
- ensure that the design periods and factors for safety for all site works take into account extreme events and other natural processes such as erosion.

6.14.2 Preliminary Closure and Rehabilitation Criteria

Completion criteria will be utilised to demonstrate achievement of rehabilitation objectives/performance standards. The preliminary closure and rehabilitation completion criteria for the Modification are outlined in **Table 6.27**. These will be subject to ongoing refinement over the life of the quarry and will be incorporated into the updated Rehabilitation and Landscape Management Plan.

Table 6.27 Preliminary Closure and Rehabilitation Completion Criteria

Aspect	Preliminary Completion Criteria
Decommissioning	All infrastructure which does not have a potential future use associated with the post-quarrying land use will be removed, unless such removal has a greater environmental impact than rehabilitating the area with the infrastructure remaining in place.
	Removal of all services which do not have a potential future use associated with the post-quarrying land use (power, water, communications).
Landform	No significant erosion is present that would constitute a safety hazard or compromise the capability of supporting the final land use.
	Contour banks are stable and there is no evidence of overtopping or significant scouring as a result of runoff.
	Surface is free of any hazardous materials.
Soil	Topsoil or a suitable alternative has been spread uniformly over the rehabilitation surface.
Water	Runoff water quality from the site does not pose a threat to downstream water quality.
Vegetation	There is no significant weed infestation.
	Native vegetation areas have established within the rehabilitated proposed extraction area.
	Trees planted as part of rehabilitation have reached maturity, maturity being defined as when trees are capable of producing fruits and flowers.
Bushfire Hazard	Appropriate bushfire hazard controls have been implemented.

The preliminary closure criteria will be reviewed and revised throughout the Project life and used as the basis for further refinement following the commencement of rehabilitation activities; consideration of the results of rehabilitation monitoring programs; and consideration of any stakeholder feedback.

6.14.3 Proposed Final Landform

The proposed final landform for the quarry involves re-filling and contouring the extraction area to achieve a landform consistent with the surrounding topography and pre-quarrying landform. The conceptual final landform for the quarry is shown in **Figure 6.21**. Further details on the rehabilitation methodology to achieve the landform design are outlined below.

Quarry Extraction Area

Rehabilitation of the quarry pit will be commenced progressively following completion of each stage of extraction. As described in **Section 3.0**, the final landform levels for Cell 1 would be achieved using tailings from the wet processing plant from the extraction of Cells 1 and 2 as required. The silt pond in Cell 1 would be capped and rehabilitated using stockpiled overburden and topsoil.

Once the final landform levels are established in Cell 1, vegetation from Cell 3 would be translocated to Cell 1 to achieve final rehabilitation. Extraction in Cell 4 would not commence until rehabilitation in Cell 1 was complete. This process would continue so that cells are progressively rehabilitated south to north in sequential stages.

Where sufficient material from the quarrying process (e.g. tailings or other unsuitable material) is unavailable, VENM or ENM (or equivalent classification) may be imported to the site to contribute to backfilling of the quarry void. The extraction area will be re-filled and contoured to achieve a landform consistent with the surrounding topography and pre-quarrying landform. Permanent dams will be established in the lower reaches of the extraction area to provide for sediment control during the vegetation establishment phase and will likely be retained in the final landform.

Surface Infrastructure

During the decommissioning process, the processing plant and quarrying infrastructure not required to support the post-quarrying land use will be removed. Where required, the areas occupied by these facilities would be re-profiled, deep ripped, topsoiled and revegetated with pasture grass species. Infrastructure with the potential to support the post quarry land use may be retained following consultation and agreement with the relevant landowners.

6.14.4 Rehabilitation Strategy

As discussed in **Section 6.16.4**, rehabilitation will be completed progressively as part of the ongoing development of the quarry. The proposed extraction area will be returned to native vegetation, primarily using topsoil and cleared vegetation from each progressive extraction area to re-spread over rehabilitated areas. This will be supplemented by planting of native species as required.

Further details on the approach to rehabilitation will be included in the updated Rehabilitation and Landscape Management Plan.

FIGURE 6.21

Proposed Final Landform

0 100 250 500m
1:10 000

Image Source: ERM (2016)
Data Source: Mc Kinlay Morgan & Associates Pty Ltd (2014)

File Name (A4): R05/3479_054.dgn
20160914 15.07

6.14.5 Rehabilitation Monitoring and Maintenance

A rehabilitation monitoring program will be implemented to include the aspects outlined below.

Rehabilitation Monitoring

Annual inspections of rehabilitated areas will be undertaken over the life of the Project to assess soil conditions and erosion, drainage and sediment control structures, runoff water quality, revegetation germination success, plant health and weed infestation. Where necessary, remediation measures will be implemented and rehabilitation procedures will be amended accordingly with the aim of continually improving rehabilitation standards.

The objective of this monitoring is to evaluate the progress of rehabilitation towards fulfilling long term land use objectives and criteria. The monitoring program will be continued until it can be demonstrated that rehabilitation has satisfied the rehabilitation and closure criteria. Information from this monitoring program will also be used to refine rehabilitation and closure criteria as required.

Rehabilitation Care and Maintenance

Dependent upon the outcomes of the rehabilitation monitoring as outlined above, the scope of the rehabilitation care and maintenance may include the following:

- weed and feral animal control
- erosion and sediment control works
- re-seeding of rehabilitation areas that may have failed
- maintenance fertilising
- repair of fence lines, access tracks and other general related land management activities.

7.0 Summary of Environmental Management Measures

Dixon Sand has an existing Environmental Management Strategy and associated management plans and systems which guide environmental management at the Haerses Road Quarry. These plans will be revised and updated as part of the implementation of the Modification. A summary of the key management and mitigation measures proposed to be implemented as part of the Modification Project is provided below, focussing on the additional controls to be implemented as part of the Modification.

7.1 Update of Management Plans and Programs

- Within 12 months of the granting of approval for the modification, or as otherwise agreed with DP&E, Dixon Sand will update all of the environmental management plans and programs required by the development consent.

7.1.1 Groundwater

- Monitoring will be continued for the life of the Haerses Road quarry operations to continue to refine the mapping of the extent of the MTSGS and the wet weather groundwater level in both the MTSGS and the SCBGS to allow appropriate buffers to be maintained throughout the life of the quarry.

- No extraction would be undertaken within the 100 metre buffer of the MTSGS until two additional monitoring bores within the western margin of the MTSGS have been established and monitoring shows that quarrying can be undertaken in this area without impacting on the MTSGS. The decision to commence quarrying in this area will be undertaken in consultation with DPI Water and with the approval of DPE.

- The depth of quarrying will maintain an elevation which is at least two metres above the 'wet weather' groundwater elevation for the SCBGS.

- A TARP for groundwater will be developed as part of the ongoing groundwater monitoring program to focus upon appropriate trigger and response actions for the management or mitigation of any unpredicted impacts that occur. The monitoring program that is in place will be used to establish the triggers, which will be designed to identify any potential impacts and trigger an appropriate response.

7.1.2 Surface Water

- During the construction of infrastructure for the Modification all works and associated erosion and sediment controls will be inspected monthly and maintained as required to ensure that all required controls are in place and effective.

- All erosion and sediment controls will be designed, constructed and managed in accordance with the Blue Book Volumes 1 and 2.

- Following the completion of construction works, the work areas will be inspected monthly and after any rainfall events generating runoff until revegetation and stabilisation of drainage structures are complete.

- During the operational phase of the Modification, inspections of the water management controls will be undertaken on a monthly basis and after storm events (i.e. greater than 50 mm rainfall in 24 hours).

- The walls of all water management dams will be inspected biennially (every two years) for their structural integrity and for any maintenance requirements. The walls of the water management dams will be grassed and kept free of any trees and shrubs.

- Visual inspections of water quality will be undertaken after storm events and a comment on visual water quality will be included on any erosion and sediment control inspections that are undertaken.

- Monthly surface water monitoring of the in-pit sump is proposed to provide for ongoing monitoring of site water quality.

- Dixon Sand will monitor the site water balance through monthly monitoring of site water usage and changes in dam water volumes, to determine an annual site water balance.

7.1.3 Noise

- The existing noise monitoring program will be modified to incorporate additional noise monitoring at the potentially most affected locations near the south-western end of the site, such as Location R6 and R8, when extraction operations are being conducted in the additional extraction area.

- A Noise Management Protocol will be prepared and implemented prior to commencing campaign works such as clearing of the extraction cells, early pre-stripping works and construction of the noise bunds. Measures to be included in the Protocol are:

    - consultation with the nearest residents prior to work commencement advising them of the potential for elevated noise levels, the timing of works, duration and taking into consideration times that might be of least disturbance to them

    - provision of a contact and telephone number to raise any concerns during the works.

- The following noise controls (or alternative achieving the same outcome) will be incorporated into the design of the Modification:

    - locate the crushers and screen within the wet processing plant area, where the distance between the plant and nearest dwellings is maximised

    - construct a minimum 7 metre bund (or combined bund / noise fence) along the western boundary of Cell 4, with a minimum 80 metre return along the northern boundary of the cell prior to early extraction works in Cell 4

    - construct a minimum 7 metre bund (or combined bund / noise fence) set back a minimum of 50 metre from the western boundary of Cell 5 prior to early extraction works in Cell 5. Due to conditions of the local topography, location of the bund at the western boundary would require a significantly higher bund for little benefit

    - either one of dozer or front end loader (not both) to operate in Cell 4 and Cell 5 during early extraction, clearing or construction of bund walls, to minimise noise

    - during early extraction works (at or near surface level) in Cell 4 and Cell 5, product to be stockpiled and hauled away separately so that extraction does not occur simultaneously with haulage.

- There are a number of additional noise control measures or operational procedures available for consideration on an as-needed basis to assist in managing noise emissions on site. The implementation of these measures or operating procedures may depend on operational and meteorological conditions. Additional noise management measures that will be considered include:

    - utilising stockpiles located between near surface loading activities in the extraction cells and nearest receivers (in particular R6 and R8), where this is possible

    - in the wet processing plant area, locate stockpiles along the western boundary of the area to shield loading/unloading activities. In particular, locating stockpiles as close as possible to the crushers and screen, between these plant items and the nearest receivers (in particular R6 and R8) would be beneficial, if possible

    - construction of the earth bund walls in Cell 4 and Cell 5 as early as possible following clearing and early pre-stripping so that subsequent pre-stripping works at the western end of the extraction cells will benefit from the acoustic shielding provided by the bund walls

    - when excavating within the extraction pits, where and when possible, excavation should be such that the western excavation face is the working face. This maximises acoustic shielding

    - where noise from the dry and wet plant is found to be directional, orientate the plant so that the quieter direction is towards the closest and most affected receptors (e.g. R6 and R8), where this is feasible

    - switch engines on mobile plant off when stationary rather than on idle

    - make operators of mobile plant aware of measures to minimise impacts on sensitive recievers particularly during operations in Cells 4 and 5, and provide adequate training so that quiet operating procedures can be implemented, where feasible and reasonable.

7.1.4 Air Quality

- The following air quality management measures will continue to be implemented at the site as part of the Modification:

    - Use of a water cart to control emissions from haul roads (unsealed).

    - Enforcement of speed limits onsite.

    - Progressive rehabilitation of exposed areas.

    - Minimising drop height of material during truck loading and unloading where possible.

    - Management of dust generating activities during unfavourable meteorological conditions.

7.1.5 Ecology

- Dixon Sand will implement the following measures to minimise the potential impacts on the biodiversity of the Modification area and the locality:
    - ongoing weed management
    - ongoing sediment and erosion controls
    - a tree felling procedure will be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees
    - employee education and training including inductions for staff, contractors and visitors to the site, to inform personnel of the biodiversity issues present at the site and their role and responsibilities in relation to the protection and/or minimisation of impacts to biodiversity
    - areas of biodiversity value outside the proposed extraction area will be fenced or signposted, where appropriate, to prevent the unnecessary disturbance
    - traffic control measures/speed limits/signage will be utilised on haul roads and access roads to minimise fauna injury/road kills.
- Dixon Sands will retire biodiversity credits as outlined in **Section 6.7** prior to the disturbance of native vegetation in the Modification area. The credits may be retired progressively based on the staging of native vegetation disturbance in line with the progressive development of the quarry. Dixon Sands will retire credits for the first stage by 12 months post the date of approval of the Modification. The area of progressive disturbance and associated credits retired will be reported annually, along with an indication of when the next stage of disturbance requiring further credits will occur. Credit retirement will be undertaken in accordance with the Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH September 2014).

7.1.6 Aboriginal Heritage

- Dixon Sand will ensure that its employees and contractors are aware that it is an offence under Section 86 of *the National Parks and wildlife Act 1974* (NPW Act) to harm or desecrate an Aboriginal object unless that harm or desecration is the subject of an Aboriginal Heritage Impact Permit (AHIP) or other approval.
- The Modification area does not contain any identified Aboriginal archaeological sites, however, in the unlikely event that previously unrecorded artefactual material is exposed during ground disturbance works within the extraction area, work will cease in the vicinity of the artefactual material and the registered Aboriginal parties contacted and the artefactual material managed in accordance with a methodology to be prepared in consultation with the registered Aboriginal parties and OEH, if required.
- In the unlikely event that suspected human skeletal material is identified, all works in the immediate vicinity of the suspected human skeletal material will cease and the skeletal material will be inspected to determine if it is human (including assessment by a forensic specialist if required). If the skeletal material is human, the NSW Police and OEH will be contacted. No excavation will proceed until an appropriate course of action has been determined in consultation with NSW Police, OEH and the Aboriginal parties.

7.1.7 Social

- Dixon Sand will maintain the CCC and will regularly report to the CCC the progress of the Haerses Road Quarry and associated environmental management measures.

7.1.8 Greenhouse Gas and Energy Assessment

- Dixon Sand will review opportunities for diesel use efficiency when purchasing or replacing equipment at the quarry and will appropriate maintain all equipment to provide for efficient operations.

7.1.9 Rehabilitation

- The Rehabilitation and Landscape Management Plan will be updated for the Modification to incorporate the rehabilitation of the proposed extraction area.

- As part of the detailed quarry planning process, a detailed Quarry Closure Plan will be developed approximately three years prior to cessation of quarrying activities. The Quarry Closure Plan will describe in detail the proposed operational and progressive rehabilitation procedures for the remainder of the quarry life and subsequent to the quarry closure.

- Rehabilitation monitoring and maintenance will be undertaken as outlined in **Section 6.14.5**.

8.0 Conclusion and Ecologically Sustainable Development

8.1 Ecologically Sustainable Development

The EP&A Act aims to encourage ecologically sustainable development (ESD) within NSW. As outlined in **Section 4.0**, the Modification requires approval under Section 75W of the EP&A Act. As such, the consent authority needs to be satisfied that the quarry is consistent with the principles of ESD. This section provides an assessment of the Modification in relation to the principles of ESD.

To justify the Modification with regard to the ESD principles, the benefits of the quarry in an environmental and socio-economic context, with the Modification, should outweigh any negative impacts. The ESD principles encompass the following:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity
- valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

8.1.1 The Precautionary Principle

The EP&A Regulation defines the precautionary principle as:

> *Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*
>
> *In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options.*

In order to achieve a level of scientific certainty in relation to potential impacts associated with the Modification, this EA has undertaken an extensive evaluation of all the key components. Detailed assessment of all key issues and necessary management procedures has been conducted and is comprehensively documented in this EA.

The assessment process has involved a detailed study of the existing environment and the use of engineering and scientific modelling and study to assess and determine potential impacts as a result of the Modification. To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

The decision making process for the design, impact assessment and development of management processes has been transparent in the following respects:

- relevant government authorities and community representatives were consulted during EA preparation (refer to **Section 5.0**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.

- the approved quarry incorporates environmental management plans, procedures and environmental monitoring, that will be revised in regard to the Modification. In addition, the management controls that will be implemented by Dixon Sand as part of the implementation of the quarry have been clearly specified in **Section 7.0** and the development consent for the approved Haerses Road Quarry.

- this EA has been undertaken on the basis of the best available scientific information about the Modification area. Where uncertainty in the data used in the assessment has been identified, a conservative worst case analysis has been undertaken and contingency measures have been identified to manage that uncertainty

8.1.2 Intergenerational Equity

The EP&A Regulation defines intergenerational equity as:

> *Intergenerational equity namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, bio-diversity and productivity.

The modified quarry would provide a long-term, high quality supply of sand and sandstone products into the Sydney, local and regional markets. This supply will assist to meet the current and growing demand for high quality sand products. As part of quarrying operations a comprehensive rehabilitation strategy has been developed, including an approved Rehabilitation and Landscape Management Plan. The Rehabilitation and Landscape Management Plan provides a description of the strategies that will be used to rehabilitate the areas disturbed from quarrying operations and will be updated as part of the implementation of the Modification.

As detailed in **Section 6.0**, the proposed modifications can be undertaken without having a significant impact on the local environment or community. The environmental management measures discussed in **Sections 6.0** and **7.0** have been developed to minimise the impact of the Modification on the environment and community to the extent reasonably practicable.

The management of environmental issues as outlined in this EA will assist to maintain the health, diversity and productivity of the environment for future generations whilst also realising the benefits of the quarrying operations.

8.1.3 Conservation and Biological Diversity

The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the Modification are described in this EA. Potential impacts are also outlined and measures to offset the impacts of the Modification developed in accordance with NSW government policy.

Dixon Sand undertook initial ecological field surveys to inform its design process for the proposed extraction area. Through this process, various extraction area boundaries were considered as Dixon Sand sought to minimise the biodiversity impacts associated with the Modification whilst providing an economic resource. Key factors in selecting the location of the extraction area boundary included the likely impacts on significant ecological features, including threatened species, threatened ecological communities and/or their habitats. Key ecological constraints that were considered by Dixon Sand during the design phase of the proposed extraction area include the location and extent of the Coastal Upland Swamp TEC and the population of the threatened flora species *Darwinia biflora*.

For the ecological impacts that cannot be avoided, Dixon Sand is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the loss of ecological values as a result of the Modification under the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014).

In addition, the approved Rehabilitation and Landscape Management Plan for the quarry will ensure that native vegetation will be established in the rehabilitated extraction area which will assist in improving the ecological values of the site in the medium to long term.

8.1.4 Valuation and Pricing Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

The Modification optimises the valuation and pricing of the sand and sandstone resource with minimal impact by:

- ensuring a high quality resource of sand and sandstone products is available in close proximity to the Sydney, local and regional markets
- maximising the efficient extraction of the sandstone resource through detailed design and planning.

Feasibility considerations during the design process for the Modification have included the costs of integration of effective management measures to minimise potential environmental and social impacts.

8.2 Conclusion

Dixon Sand is seeking to modify the existing Haerses Road Quarry development consent to increase the extraction area and to increase the volume of sand and sandstone products sold direct to market from the site. The proposed changes would allow Dixon Sand to contribute to meeting the recent increase in demand for medium to coarse grain sands and specialist sands in the Sydney market. The modified quarry would provide a long-term, high quality supply of construction materials at very close proximity to the local Sydney and regional markets, contributing to the security and economic viability of the Sydney construction industry along with supply to other key sand markets.

This EA has identified that the proposed modifications would generally result in impacts similar to those of the currently approved operations. Impacts to biodiversity would be managed through the establishment of on-site and off-site biodiversity offset areas and other measures in accordance with current NSW government policy. The EA has identified the required management and mitigation measures to be implemented as part of the Modification, building on the measures provided in the existing consent conditions.

On considering the balance of the potential impacts of the Modification to the approved quarry on the environment and community, and the benefits of the proposed changes, it would be reasonable to conclude that the benefits of the proposed modifications outweigh the impacts.

9.0 References

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APPENDIX 1

Statement of Authorship

Statement of Authorship

EA prepared by	
Name:	John Merrell, Group Manager Environment & Community NSW
Qualifications:	B. Env. Sc
Address:	Umwelt (Australia) Pty Limited 75 York Street Teralba NSW 2284
In respect of:	Haerses Road Quarry Extraction Area Modification
Applicant Name:	Dixon Sand
Applicant Address:	4610 Old Northern Road Maroota, NSW 2756
Land to be developed:	See **Appendix 1** of the accompanying Environmental Assessment (EA) for the Schedule of Lands.
Proposed Development:	Lynwood Quarry Extraction Area Modification as described in the accompanying Environmental Assessment.
Environmental Assessment	An EA is attached.
Certification	I certify that I have prepared the contents of this environmental assessment and to the best of my knowledge: • it is in accordance with the relevant provisions of the *Environmental Planning and Assessment Act 1979*, and • it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.
Signature:	
Name:	John Merrell
Date:	22 September 2016

Project Team

Umwelt (Australia) Pty Limited – EA Preparation	
John Merrell, Group Manager, Environment & Community - NSW B Env Sc	Project Director
Lachlan Sweeney, Senior Environmental Scientist - B Sc, (Hons)	Project Manager
Travis Peake, Practice Leader Ecology – B Nat Res (Hons)	Ecological Assessment
Bill Wallach, Senior Ecologist – B Sc (Hons)	Ecological Assessment
Susan Shield, Manager Water Resources Engineering/Associate B E (Hons), M E (Water),	Surface Water Assessment and Water Balance Assessment
Melissa Harrow, Senior Environmental Engineer -B Env Eng (Hons)	Surface Water Assessment, and Water Balance Assessment
Tim Procter, Manager Engineering Services/Associate B Eng (Chem) (Hons)	Noise Impact Assessment
Glenn Homes, Principal Acoustician - BE (Hons) Mech (Sydney University) MIEAust CPEng	Noise Impact Assessment
Nicola Roche, Manager Cultural Heritage – B A (Hons) Anthropology	Aboriginal Cultural Heritage and Archaeological Assessment
Alison Lamond, Archaeologist –B Sc (Geology & Geophysics) B A (Hons) Archaeology	Aboriginal Cultural Heritage and Archaeological Assessment and Historic Heritage
Malcolm Sedgwick, Principal Energy & Greenhouse Specialist B Sc	Greenhouse Gas and Energy Assessment
Kristine Bencke, Senior Social Consultant – B A Social Science	Social Impact Assessment
Michael Ong, Senior Draftsperson Rebecca Abbott, Drafting Supervisor – Major Projects	Drafting, Graphic Design Drafting, Graphic Design
Joelle Brockman, Project Administrator Diploma of Business Management	Report Formatting and Document Control

Other Specialist Investigations	
Pacific Environment Operations Pty Ltd Judith Cox Angelo Ruggos	Air Quality Impact Assessment
Australian Groundwater Technologies Jason van den Akker	Groundwater Assessment
SECA Solution Sean Morgan	Traffic Impact Assessment

APPENDIX 2

Community Consultation Flyer

Dixon Sand (Penrith) Pty Ltd

Dixon Sand

HAERSES ROAD QUARRY

APRIL 2016

Dixon Sand currently operate the Haerses Road quarry, extracting tertiary Maroota sand in accordance with their existing development consent. Dixon Sand has identified the opportunity to extract an adjacent area of friable sandstone from within the quarry, and are seeking approval for the extraction and rehabilitation of this area. The proposed extraction area is within the Sydney Regional Environmental Plan No. 9 - Extractive Industry (No 2 - 1995) precinct. **Figure 1** shows the existing approved extraction area and the proposed additional extraction area.

It is not proposed to increase the volume of material extracted from the site per year, hence truck movements to and from the site would not increase from what is currently approved.

Dixon Sand will prepare an application, including an environmental assessment, to be lodged with the NSW Department of Planning and Environment (DP&E) seeking approval for the additional extraction. The environmental assessment which is being prepared by Umwelt (Australia) Pty Limited (Umwelt) will address the following issues: traffic, noise, air quality, ground and surface water, ecology, Aboriginal heritage and socio-economic aspects.

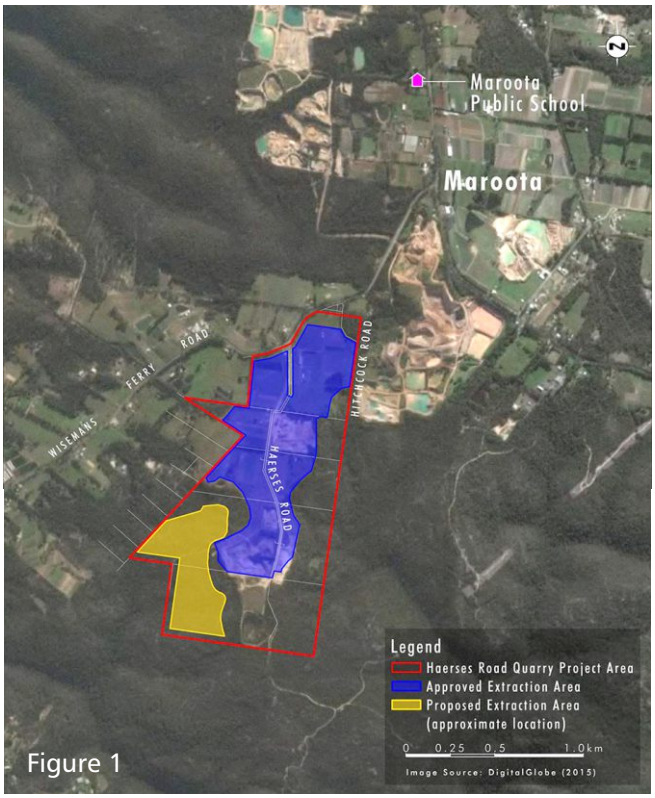

Figure 1

PROJECT TIMING ▼

WE ARE HERE

Conceptual Quarry Plan	August 2015
Lodgement of Background Scoping Document	October 2015
Preparation of Environmental Studies	November 2015 - Mid 2016
Finalise EA for submission and public exhibition	Mid 2016
Response to submissions	Mid - Late 2016
Assessment and Determination	Late 2016

It is anticipated that the application will be lodged with DP&E in mid 2016. Updates on progress of the application will be available via the 'Keeping Informed' tab on the Dixon Sand website:

www.dixonsand.com.au

For further information or to raise any concerns you have in relation to the proposal you can contact **David Dixon** from Dixon Sand on **0414 330 490** or via email at **david@dixonsand.com.au.**

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